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PRINCIPAL CONTENTS

	PAGE
Features	
Leader: Human Relations in Industry	113
Correspondence	114
New Catalogues	125
Parliamentary	126
New Equipment	132
Company News (Advert. section)	29
Technical	
Solubility of Hydrogen in Iron/Carbon Alloys, by B. G. Davies, Ph.D., and T. Evans, B.Sc., F.Inst.Fuel	115
American Developments in Plaster Casting, by B. H. C. Waters, Ph.D., M.A.	123
Simple Foundry Expedients Proved Worthwhile in Recent Years, by J. E. O. Little	127
News	
Death of Mr. P. H. Wilson, O.B.E.	114
Ruston & Hornsby Changes	114
Industrial Safety and Production	114
Work-study Week-end	125
International Foundry Congress, 1954	131
British Steel Castings Research Association Exhibition	134
Personal	134
News in Brief	136
Obituary	137
Raw Material Markets	138
Statistics	
Latest Foundry Statistics	135
Current Prices of Iron, Steel and Non-ferrous Metals (Advert. section)	28

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Human Relations in Industry

We have often been impelled adversely to criticize papers, lectures and other publications dealing with psychological aspects of human relations, but ever since the Melchett-Turner report on this subject we have been staunch in support of all practical efforts designed to bring about the team spirit in industry. The Government, through the Ministry of Labour and National Service, is most anxious that increasing efforts should be made by employers, trade unions, and the nationalized industries to give practical support to the achievement of this laudable movement. To-day, it is believed that the institution of good human relations in industry is the embodiment of our democratic way of life.

As an earnest of the Government's endeavours, the Department referred to has issued a leaflet "Human Relations in Industry," which sets out quite shortly the steps they wish to be taken by industry and by way of demonstration of what can be done they have organized a small exhibition—"Information Within Industry"—showing in a minimum of space current activities. It is now on view at the House of Commons, and—though not exactly within their purview—through the local Productivity Councils all over the country. The exhibition calls attention, rightly, without making any recommendations, to such activities of works joint consultation councils, house magazines, the notice boards and the publication of various documents which give current trading conditions, prospects, profit and what happens to them, and so forth. There is expressed a desire to show to the working staff not only their relationship to the firm, but also the relation of the firm to the national economy. This is a formidable but important task; nevertheless, it is one that has the wholehearted support of Government, employers and trade unions, and the initiative must come from the employer. Whichever method of those indicated be chosen, it must be re-examined critically and frequently to see if better results could not be obtained.

The Ministry have the intention to further the campaign by the production of a full-length film on "Human Relations in Industry," which should be showing by the end of the year. The policy of the Government is against either Charters or Codes, but is placing reliance on the good sense of the British public and has decided to do everything it can to popularize the campaign for better human relations, whilst refraining from direct interference. The Government has made the challenge; it has shown what means are already being adopted and the choice is left to the individual to select the method in which he has most confidence and, having made his selection, prosecute the system with real vigour.

E

Death of Mr. P. H. Wilson, O.B.E.

The death is announced of Mr. Percy H. Wilson, O.B.E., M.I.Mech.E., a past president of the Institute of British Foundrymen, which he joined in 1918. He was 69. Much of his life time has been spent with the Stanton Ironworks Company Limited, where he rose from the position of foundry general manager to that of deputy managing director. It was during this period that he pioneered, successfully, the production of centrifugally cast iron pipe, and his name will always be associated with this important development. The award of the E. J. Fox gold medal in 1942 associated him with this development. During the first war, he was instrumental in conjunction with the Ministry of Munitions in producing specifications for high duty irons, whilst during the second one, he was responsible for the design, construction and operation of one of the largest mechanized foundries for the mass production of steel bombs. For this service he was awarded the O.B.E. in 1943.

Mr. Wilson was deeply interested in metallurgical research and he presided over the Britist Cast Iron Research during the period 1948-50. A lifelong activity has been the training of youth for the foundry industry, As long ago as 1908, he was a part-time lecturer in engineering subjects. He was responsible for the installation of a fully equipped and very successful training centre at Stanton, which was opened in 1947. In 1951, Mr. Wilson was appointed by the Minister of Education to be chairman of the Governors of the National Foundry College—a position he still held at the time of his death. He invariably lent his personal support to the foundrymen's training courses held annually at Ashorne Hill organized by the Institute of British Foundrymen.

In 1950 he was admitted as a Serving Brother to the Order of St. John of Jerusalem. In 1948, Mr. Wilson became a Liveryman of the Worshipful Company of Founders and a Freeman of the City of London.

Mr. Wilson led an extremely active life in the course of which he made countless friends, helped many youngsters to success and gave devoted service to the many scientific, technical and works associations with which he was connected. His record is such that his name will have an everlasting place in the annals of the foundry industry.

Ruston & Hornsby Changes

The appointment is announced of Mr. J. D. Thorn as chief engineer of the engine department of Ruston & Hornsby, Limited, the Lincoln engineers. He will succeed Mr. I. Wans, who is resigning from the company. In his new appointment, which he will take up on July 19, Mr. Thorn will retain control of research and development, in addition to his new responsibilities in the direction of engine, locomotive, and pump design.

Educated at Mill Hill School and Emanuel College, Cambridge, Mr. Thorn was a trainee at the Royal Arsenal, Woolwich, and in the Royal Aircraft Establishment, Farnborough. He also spent some months studying local engineering methods in Malaya.

Mr. Thorn joined the research department of Ruston & Hornsby in 1946, as assistant research engineer, and was appointed deputy chief research engineer in 1947 becoming chief research engineer in 1949. Since joining the company, he has been closely associated with the development, from their initial conception, of many new products coming into the Ruston range of Diesel engines and locomotives.

Correspondence

STRUCTURE OF GRAPHITE SPHERULITES

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—With reference to the correspondence from Weld, Cunningham and Boswell,* we have to comment as follows:—

We did not imply that any fundamental disagreement existed between Weld, Cunningham and Boswell's and our results. In fact, most of what they had put forward has been corroborated by our experiments. We do recognize their observation that measurement of a large number of nodules showed the average core diameter to be only 10 per cent of the diameter of the nodules, as averaged over a large number of nodules and which involved no implications regarding deviations from this average. In the results reported in our original paper, however, we did not observe such overall relationship to exist although deviations thereto can be most reasonably expected. Obviously, this 10 per cent. ratio will not hold good in the case of large cores observed in small nodules (*i.e.*, sections near the periphery) and small cores observed in large nodules (*i.e.*, sections near the centre).

It is true that an examination of relative smoothness of the nodules sectioned above and below the central plane may escape an ordinary-light microscope, but will be fully revealed by an electron-microscope. This, however, has to be confirmed by a section-wise electron-microscope study of a single nodule.—Yours, etc.,

M. N. Parthasarathi.
B. R. Nijhawan.

National Metallurgical Laboratory,
Jamshedpur-7, India.
July 16, 1954

* "Correspondence," April 15, 1954, page 436. See also JOURNALS February 25 and May 27 of Vol. 96, and December 31 of Vol. 95.

Industrial Safety and Production

Attention to the relationship between safety in industry and production was drawn by Mr. E. Julian Pode, managing director of the Steel Company of Wales, Limited, when he spoke at the opening of an industrial safety exhibition at Swansea. He recalled that 25 years ago, when he first went into industry, little was done for safety, which was regarded as a matter for the individual, each man being expected to look after himself. In these days, however, it was realized that safety was the responsibility of management and they could not avoid the challenge.

Mr. Pode said that, apart from the humanitarian aspects of safety, the more they could achieve in the direction of safety the more they would be able to conserve manpower and increase production. It was not sufficient that the latest devices should be made available by the management; there must also be propaganda to persuade those in the factories to make use of them.

The exhibition, organized by the Swansea and West Wales Industrial Accident Prevention Group of the Royal Society for the Prevention of Accidents, was held at the Patti Pavilion, Swansea, from July 7 to 10. It was the first event of its kind in Wales, and a wide range of products, all of which had a bearing on safety, health, or hygiene within works and factories, was displayed. An industrial safety conference was held in conjunction with the exhibition.

THE GENERATOR for a $7,000,000 (£2,500,000) steam turbo-generating works at Halifax, Nova Scotia, is to be manufactured by the English Electric Company, Limited.

Solubility of Hydrogen in Iron/Carbon Alloys*

By B. G. Davies, Ph.D., and T. Evans, B.Sc., F.Inst.Fuel†

The equilibrium value of the solubility of hydrogen in iron/carbon alloys of carbon content up to 3.4 per cent. has been determined over the temperature range 600 to 1,000 deg. C. at pressures of one atmosphere. The effect of graphitizing white cast irons has been examined. The effect of hydrogen pressure on hydrogen solubility has also been investigated.

Since Graham[1] in 1867 showed that metals were capable of dissolving many times their own volume of gases and of evolving these gases on heating *in vacuo*, a considerable amount of work has been done on the solution of gases in metals and on the effect of this solution on the properties of the metals. Due to the frequency and ease of absorption and evolution of hydrogen by metals and of the diffusion of hydrogen through them in metallurgical operations, the effect of hydrogen on irons and steels and the amounts present in them have received considerable attention. In addition the more fundamental equilibrium solubility of hydrogen in ferrous materials under given conditions of temperature and pressure has been extensively investigated.

Pure iron has been the subject of frequent study. The equilibrium solubilities of hydrogen in pure iron have been measured by Sieverts[2] and have been confirmed by subsequent investigations[3]. These have shown that there is a sharp drop in solubility on solidification and whilst the solubility increases steadily in both the α, and the σ states, with increase of temperature, there is a slight increase in solubility on passing from the δ to the γ states and a sharp increase on passing from the α to the γ states. Whilst considerable information has been obtained on the amounts of hydrogen retained by steels and cast irons after various treatments, the number of systematic investigations of equilibrium solubility values in these materials has been much more limited.

The effect of nickel on the equilibrium solubility of hydrogen in pure iron/nickel alloys, has been studied from 0 to 100 per cent. nickel and also the effects of manganese and silicon on hydrogen solubility in their binary alloys with iron. Although individual values have been reported for the hydrogen solubility in iron/carbon alloys, no continuous investigation has been made of this effect. When carbon is present the investigation is complicated by the formation of methane by reaction between the hydrogen and carbon, presumably on the surface of the alloy or at free surfaces within the metal. There is some evidence available to indicate that difficulties due to hydrogen appear to increase and that the hydrogen solubility under equilibrium conditions might increase with increasing carbon content of the metal. The present study of the effect of carbon on the equilibrium solubility of hydrogen in iron/carbon alloys was undertaken at the instance of the Joint Gases Sub-committee of the Institute of British Foundrymen and the British Cast Iron Research Association.

Methods

If one accepts that quenching of the metal in water or in a salt solution may be insufficiently rapid to retain all the hydrogen in solution[4] then there are available two methods for the determination of the equilibrium solubility of hydrogen in a metal at a given pressure and temperature. The previously evacuated metal may be heated in a closed vessel with a known quantity of hydrogen and the quantity of hydrogen absorbed measured by changes in pressure at constant volume or of volume at constant pressure. Alternatively the metal may be heated *in vacuo* after saturating it with hydrogen at a known temperature and pressure and the volume of hydrogen evolved measured. The former method might be termed the determination of solubility by "absorption" and the latter by "extraction."

Both methods involve holding the metal sample at a constant temperature for prolonged periods under either a high vacuum or in an atmosphere of hydrogen at a constant pressure. Moreover the absorption method requires accurate temperature control over the whole of the closed vessel if the changes of the gas pressure within it are to be directly related to the solution of hydrogen in the metal. Furthermore the "dead space" in the closed vessel must be kept to a minimum to enable the small volume changes due to the solution of hydrogen to be reflected by the largest possible changes in pressure. In the extraction method control of the temperature of the whole of the closed vessel is not so critical but the dead space must be again restricted. The apparatus used for the two methods is essentially the same.

Apparatus

The specimen of metal was enclosed in a suitable ceramic tube and heated in a Kanthal-wire-wound furnace which had a zone of uniform temperature within $\pm 2\frac{1}{2}$ deg. C. over a 3-in. length at a maximum temperature of 1,000 deg. C. The furnace was constructed to take two ceramic tubes thus enabling two determinations to proceed simultaneously. To ensure rapid response to temperature fluctuations

* Presented at the fifty-first annual meeting of the Institute of British Foundrymen in Glasgow.

† The Authors are attached to the Department of Metallurgy, University College, Cardiff.

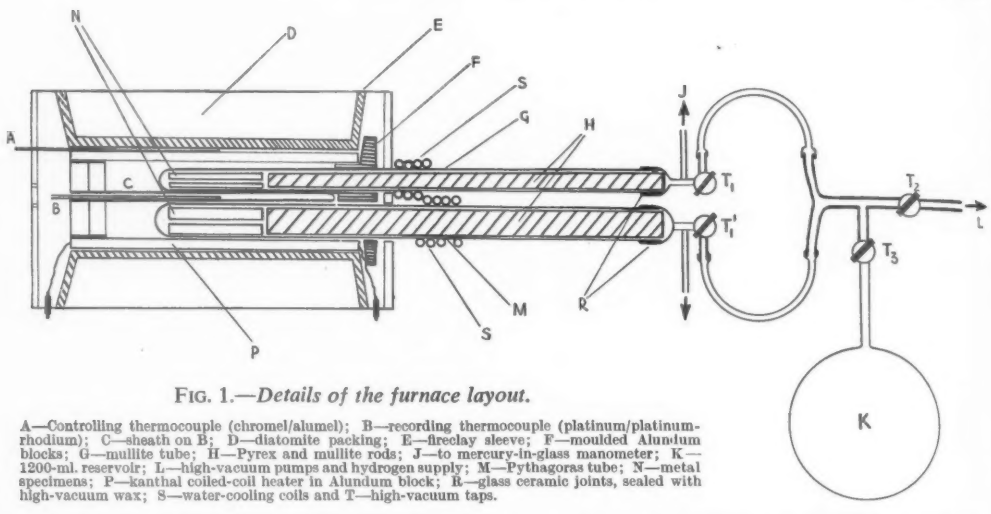


FIG. 1.—*Details of the furnace layout.*

A—Controlling thermocouple (chromel/alumel); B—recording thermocouple (platinum/platinum-rhodium); C—sheath on B; D—diatomite packing; E—fireclay sleeve; F—moulded Alundum blocks; G—mullite tube; H—Pyrex and mullite rods; J—to mercury-in-glass manometer; K—1200-ml. reservoir; L—high-vacuum pumps and hydrogen supply; M—Pythagoras tube; N—metal specimens; P—kanthal coiled-coil heater in Alundum block; R—glass ceramic joints, sealed with high-vacuum wax; S—water-cooling coils and T—high-vacuum taps.

of the furnace, the chromel/alumel controlling pyrometer, actuating a Cambridge potentiometric controller, was located in close contact with the heating wire whilst the temperature measuring thermocouple of platinum/platinum-rhodium was located in a third ceramic tube in close contact with the two tubes holding the metal samples and thus being in a similar position to the metal samples without being inside the closed vessel (Fig. 1). Such an arrangement enabled the temperature of the specimen to be held to within $\pm\frac{1}{4}$ per cent. of the recorded temperature and made possible the measurement of the temperature of the specimen to within ± 2 deg. C. at 1,000 deg. C.

The apparatus was first designed to use a single closed reaction tube and measuring system. The specimen used was 3 in. long, $\frac{7}{8}$ in. ext. dia. and pierced by a $\frac{1}{4}$ in. dia. co-axial hole. Its weight was approximately 200 gm. The apparatus (Fig. 2) was later modified to take two reaction tubes of different dimensions, using specimens of approximately 200 and 130 gm., the volumes of the two closed systems being approximately 180 and 55 ml. The ceramic reaction tubes were placed in the furnace so that, when the test specimens were at the closed ends of the tubes, the specimens were within the zone of constant temperature and near to the centre line of the furnace.

Each reaction tube was connected by a wax-sealed cup and socket joint to a glass U-loop and manifold carrying several isolating taps and connected to a 3-limbed mercury manometer, McLeod gauge, gas supply and source of vacuum. The wax-seals were protected by water-cooled coils. The volume of dead space within the reaction tubes was reduced to a minimum by the use of Pyrex and mullite filler rods.

Reaction Tubes.

Some difficulty was experienced in obtaining ceramic tubes sufficiently impermeable to hydrogen to allow correction of solubilities values for outward diffusion of hydrogen during the tests without undue loss of accuracy. Tests of various types of tubes showed that tubes of Pythagoras and mullite gave leak rates of not more than one or two ml. of hydrogen per 24 hr. at the temperatures used. Tests of these tubes at intervals during their use showed that the tubes of mullite or Pythagoras, initially satisfactory as far as hydrogen loss was concerned, did not show any appreciable change after several months use.

Vacuum Equipment.

The high vacuum necessary, better than 10^{-5} mm. of mercury, was obtained by a two-stage metal mercury diffusion pump backed by a two-stage rotary oil pump, itself capable of reaching 10^{-3} mm. of mercury pressure. A moisture and dirt trap containing silica gel was placed between the two pumps. Both the rotary pump and trap could be isolated from the system when necessary.

Gas Preparation.

The hydrogen and argon used were obtained from cylinders and were purified before use, the hydrogen by means of a train of vessels containing alkaline pyrogallol, caustic potash, calcium chloride and silica gel followed by heating to 500 to 600 deg. C. over platinized asbestos and finally drying over silica gel and phosphorus pentoxide. The argon was purified by a similar train but using bright copper wire for the removal of any residual oxygen. The residual oxygen in both gases was reduced in this way to less than 0.03 per cent. by volume. Gas analyses were made by a Haldane apparatus modified to determine carbon dioxide oxygen, carbon monoxide, hydrogen and methane. The estimated accuracy of the analyses for hydrogen, carbon monoxide and methane content was ± 0.5 per cent. by volume.

Methods of Determination

(*a*) *"Absorption" method, the change in volume of gas within the closed system due to solution of*

hydrogen being followed by measurement of changes of pressure.

The metal specimen was heated to 1,000 deg. C. in the reaction tube, the system being maintained at the highest possible vacuum, *i.e.*, better than 10^{-5} mm. mercury. These temperature and pressure conditions were maintained for eight hours after reaching 1,000 deg. C. The vacuum line was then isolated and hydrogen admitted into the system until the pressure was a little over atmospheric. Each closed vessel was then isolated by means of taps T_1 and T_1' (Fig. 1). The fall of pressure was followed by means of mercury manometers until the rate of decrease of pressure reached the steady value corresponding to the rate of loss of hydrogen through the walls of the reaction tube at 1,000 deg. C. This rate of diffusion was checked by continued pressure measurements for a further 24 hr.

The closed system was then evacuated for at least eight hr. to remove all hydrogen, and the temperature dropped to the next lower temperature of determination and the same procedure repeated for several temperatures between 1,000 and 600 deg. C. The evacuation between determinations was always carried out at 1,000 deg. C., and the furnace held at the temperature of determination for at least one hr. before each determination at temperatures lower than 1,000 deg. C. The quantity of gas, measured as ml. at S.T.P., within the closed system was determined for each temperature so that the pressure changes would be directly related to volumes of hydrogen in ml. at S.T.P. absorbed.

The decrease in pressure observed was due to (*a*) hydrogen dissolved in the metal, (*b*) hydrogen dissolved in filter rods and tube walls or absorbed by them, and (*c*) hydrogen escaping through the walls of the reaction tubes. Blank determinations under similar conditions of temperatures and pressures were carried out to obtained corrections for the factors (*b*) and (*c*). It was found impossible to prevent small variations of temperature of those parts of the reaction tubes surrounded by water-cooled coils and by air. The use of filter rods minimized the inaccuracies due to these variations. A small correction was applied to compensate for the small variation in pressure due to these causes.

Determination of Quantity of Hydrogen within the Reaction System.

The quantity of hydrogen as atmosphere within each closed tube was determined during each determination in the following way. At the end of each determination, the glass manifold including the large reservoir were evacuated thoroughly as far as taps T_1 or T_1' (Fig. 1) and the pumping train isolated. The pressure between the evacuated reservoir and the reaction system was equalized by opening and then shutting the appropriate tap T_1 or T_1'. The measurement of the gas pressures on the two parts of the apparatus, the reservoir and the closed system, before and after equating pressures made it possible to calculate the quantity of gas in the closed system, provided the volume of the reservoir was known. This operation had to be carried out without undue delay since hydrogen diffused out of the test specimen under the reduced pressure. A number of check determinations using argon was made and gave values which agreed with those obtained during the actual determinations with hydrogen. It was estimated that up to 1,000 deg. C., the calculated quantity of gas atmosphere over the metal was accurate to within a few tenths of the millilitre measured at S.T.P.

Using the "absorption" method, determinations of the equilibrium solubility of hydrogen in pure iron, ingot iron and a low carbon steel were made over the temperature range 1,000 to 600 deg. C. At the end of each series of determinations, the determination at 1,000 deg. C. was repeated to examine the effect of continued saturation and evacuation on the behaviour of the specimen. Any variations found were within the spread of experimental errors. With carbon containing materials, the calculation of solubility values was complicated by reaction between the hydrogen atmosphere and the alloying carbon forming methane during the prolonged soaking treatment. The changes in pressure due to the presence of methane gave marked additional pressure losses, which made it difficult to calculate the solubility values, particularly so at the lower temperatures where methane formation was greatest and hydrogen solubility least. The alternative "extraction" method was therefore used for work on iron/carbon alloys.

(*b*) *Extraction Method.*

The extraction of gases from metal specimens by vacuum heating is a well established method. The normal method has been to measure the gas retained in a specimen which has been soaked in the gas, and then quenched quickly to room temperature. This may be determined either by vacuum heating or vacuum fusion. The vacuum fusion method also

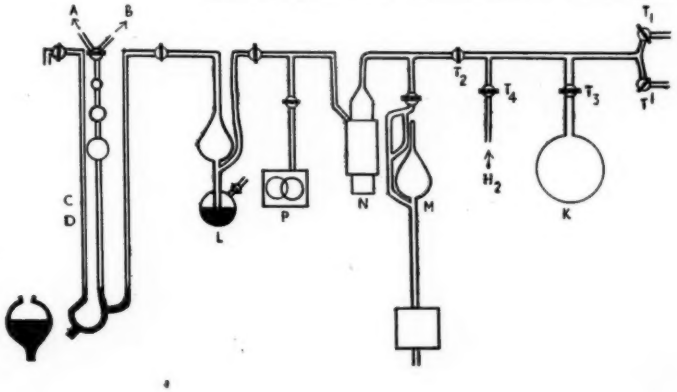


FIG. 2.—*General sketch of the apparatus.*

A—To air; B—to gas analyser; C—gas burette; K—gas reservoir; L—Toepler pump; M—McLeod gauge; N—mercury diffusion pump, and P—rotary pump.

implies the destruction of the test specimen after one determination. There is some evidence that the full amount of hydrogen present at the temperature of soaking, and particularly at the higher temperatures, is not retained by any system of quenching. It was therefore considered that the normal method of quenching was not very suitable for equilibrium studies without important modifications.

If a closed system in which a metal has been thoroughly saturated with hydrogen at a given temperature and pressure is evacuated, hydrogen will be removed from (*a*) the gaseous phase surrounding the specimen (V_1), (*b*) the metal itself (V_2), (*c*) the tube and filler materials, including any hydrogen absorbed on the cooler parts of the tube and fillers (V_3). Furthermore, any air diffusing inwards through the heated portion of the reaction tubes will also appear in the gas (V_4). Previous experiments had however shown that V_4 could be neglected with the tubes investigated at all temperatures and pressures. The amount of gas evolved by the metal was determined in this way. The quantity of gas as atmosphere was first determined at any required temperature and pressure by the method described above (V_1), and blank determinations carried out without the specimen to determine the gas evolved by the tube walls and filler materials (V_3). Determinations carried out with the metal specimens in use were then made giving (V_2+V_3) from which V_2 was obtained by difference.

The most critical determination was found to be that of the volume of the gas phase with and without the specimens. It was estimated that by the method described above for the "absorption" method, the quantity of gas in the gaseous phase could, at any set temperature and pressure, be determined to a few tenths of a millilitre at S.T.P. During the "absorption" experiments already described, it was found that equilibrium solution was attained in 4 hr. at 1,000 deg. C. and in 16 hr. at 600 deg. C. The time at 1,000 deg. C. agrees with that found by Martin in similar experiments. The time allowed for complete saturation was therefore fixed at 16 hr.; in a few cases a longer time was allowed and the results obtained were used as a check of the time necessary. With cast irons, the soaking time was reduced to 4 hr. to avoid the possible effects of structural changes when the specimens were held at 1,000 deg. C. for long periods; check determinations were then made in such cases at the end of a series of determinations using the normal time of soaking, *i.e.*, 16 hr.

Since the standard procedure was to evacuate all specimens at 1,000 deg. C. prior to saturation, it was found possible to approach equilibrium at any lower temperature from a gas concentration within the metal either higher or lower than the equilibrium value. Work on pure iron had shown that soaking in hydrogen at 1,000 deg. C. for 1 hr. gave a hydrogen concentration in the metal greater than the equilibrium value at all temperatures lower than 950 deg. C. Thus soaking at 1,000 deg. C. for 1 hr. followed by lowering of the temperature to the required value allowed equilibrium to be attained by the evolution of hydrogen from the test specimen; this evolution could be followed in a general way by changes in pressure measured by a mercury manometer. Again by allowing hydrogen to enter the evacuated system after attaining the temperature of determination equilibrium could be reached by diffusion of hydrogen into the test piece.

A small number of determinations were made in which the test piece was saturated in a continuous stream of hydrogen. This method was not satisfactory for samples other than pure iron or decarburized steels, due to excessive loss of carbon as methane. In the case of determinations with static atmospheres, the loss of carbon, due to methane formation, was found to be insignificant being equal to 0.01 to 0.02 per cent. approximately of the carbon content, for a series of 10 to 12 solubility determinations. To avoid the possibility of retention of part of the hydrogen in solution on evacuation at the lower temperature, all evacuations were carried out at 1,000 deg. C.

Since under the conditions of tests, it had been noted that absorption of hydrogen by pure iron was 90 per cent. complete in 1 hr. and had attained equilibrium in 4 hr., it was to be expected that the reverse process, extraction of gas under a vacuum of 10^{-5}Hg would take approximately the same time.

TABLE I.—*Composition of Test Specimens.*

	C.	Si.	Mn.	S.	P.	Al.	Ni.
(1) *Very pure iron*	0.0034	0.002	0.005	0.0055	0.001	0.002	0.01
(2) *B.I.S.R.A. Steels.*—							
B.K.K.	0.28	0.20	0.79	0.036	0.030	0.005	0.14
C.B.K.	0.34	0.30	0.75	0.035	0.037	0.02	0.08
C.A.K.	0.52	0.26	0.81	0.048	0.045	0.01	0.01
C.J.K.	0.78	0.18	0.63	0.038	0.032	0.005	0.07
D.A.K.	0.99	0.29	0.64	0.050	0.032	0.005	0.12
(3) *Ingot Iron*	0.02	0.002	0.048	0.044	0.013	N.D.	0.049
W *Steel*	0.15	0.050	0.560	0.038	0.027	N.D.	0.051
(4) *B.C.I.R.A. Fe/C Alloys.*—							
J.G.C. 29	1.11	0.05	0.02	0.020	0.022	0.09	N.D.
J.G.C. 31	1.34	0.06	0.02	0.020	0.025	0.11	N.D.
J.G.C. 34	1.67	0.06	0.02	0.021	0.029	0.10	N.D.
J.G.C. 22	1.82	0.08	0.02	0.026	0.026	Trace	N.D.
J.G.C. 35	2.02	0.05	0.01	0.019	0.027	0.10	N.D.
J.G.C. 36	2.67	0.07	0.01	0.027	0.027	0.12	N.D.
J.G.C. 30	2.94	0.04	0.02	0.018	0.033	0.08	N.D.
J.G.C. 31	3.40	0.16	0.02	0.024	0.033	Trace	N.D.

It was in fact found that by use of the diffusion and Toepler pumps, 90 per cent. of the total gas was extracted in the first 2 hr. at 1,000 deg. C. The time of evacuation was standardized at 8 hr., and the rate of gas evolution during the last 4 hr. was found to be never greater than 0.1 ml. per 100 gm. of metal and during the last hour less than 0.01 ml. per 100 gm.

As in the case of the "absorption" determinations, blank runs were made without the metal specimens to determine the apparatus constants at each temperature and pressure investigated. Each series of tests were checked by a second determination at 1,000 deg. C.

Composition and Preparation of Specimens

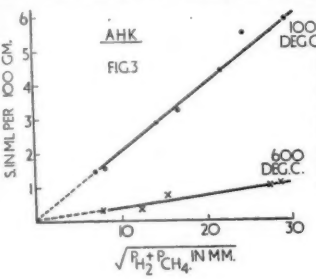
Four series of ferrous materials were investigated ranging from pure iron to a 3.4 per cent.-carbon cast iron:—

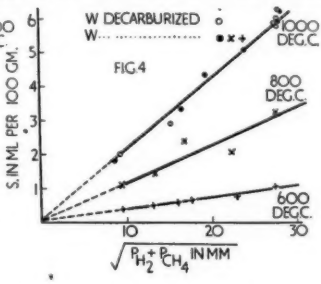
(1) A very pure iron prepared by the National Physical Laboratory, obtained from the British Iron & Steel Research Association; (2) a series of typical steels, free from porosity obtained from B.I.S.R.A.; (3) commercial samples of ingot iron and mild steel; (4) a series of very pure iron-carbon alloys prepared for this investigation by the British Cast Iron Research Association. The composition of these metal alloys are given in Table I. All the specimens were dry-machined to size, degreased with carbon tetrachloride, and washed with acetone or ether. The specimens were then dried by warming for 1 hr., cooled, weighed and then sealed in the apparatus. The apparatus was then evacuated and tested for leaks, the temperature raised to 1,000 deg. C. as rapidly as possible, with continuous evacuation for 4 hr., the gas being rejected to atmosphere. The closed vessel and contents were flushed with hydrogen and evacuated several times, prior to saturation with hydrogen for 16 hr., followed by evacuation for 8 hr. The solubility determinations were then commenced.

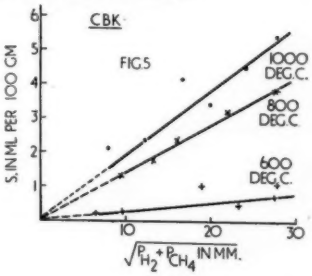
For the series of pure iron-carbon alloys prepared by B.C.I.R.A., the preliminary treatment was modified in order to determine the solubility of hydrogen in the alloys in the as-cast conditions, before the effect of any structural modifications which might have appeared due to prolonged treatment at 1,000 deg. C. in hydrogen, had become apparent. This modified treatment consisted of evacuation for 1 hr. only after the temperature of 1,000 deg. C. had been attained, the admission of hydrogen, and then evacuation 4 hr. after hydrogen admission. The determination was repeated at 1,000 deg. C. with the normal preparation and soaking time.

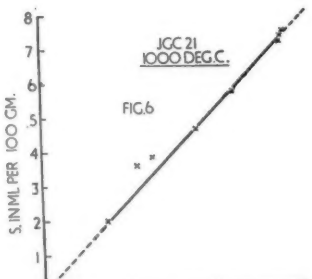
Results

The hydrogen solubilities at various temperatures were determined at pressures which varied slightly from the standard barometric pressure and for strict comparison were corrected to a standard gas pressure of 760 mm. of mercury using Sievert's square root law:—$S=K\sqrt{P}$ where S is solubility in ml. gas at S.T.P. per 100 gm., P=pressure and K is constant. The validity of this law was checked by determinations at varying pressures of saturation using pure iron, mild-steel, medium-carbon steel and one of the pure iron/carbon alloys.







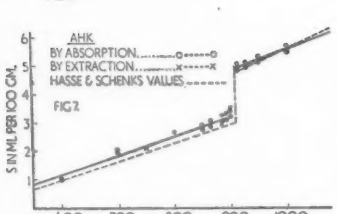


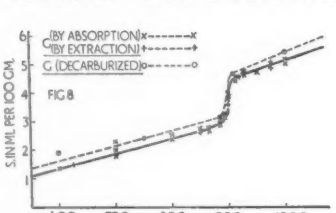
FIGS. 3 TO 6.—*Effect of pressure on hydrogen solubility;* FIG. 3.—*pure iron;* FIG. 4.—*mild steel* (0.15 *per cent. C.*); FIG. 5.—*B.I.S.R.A. steel* (0.34 *per cent. C.*); *and* FIG. 6.—*B.C.I.R.A. iron* (3.40 *per cent. C.*).

Effect of Pressure.

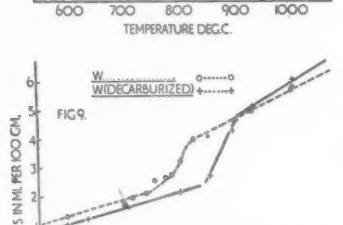
(*a*) Pure iron (Fig. 3). The results agreed with Sievert's law. The determinations at low pressure were not carried out in sufficient detail to examine the deviations from the law which have been noted at very low pressures.

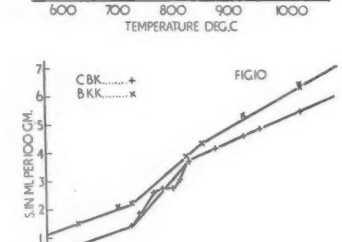
(*b*) *Mild and Medium Carbon Steels* (Figs. 4 & 5). With carbon alloys, the carbon may have some effect on the form and quantity of hydrogen dissolved in the metal, and may react with hydrogen to give methane in the gaseous phase over the metal. At 1,000 deg. C. there was little or no methane in the gas phase and Sievert's law was obeyed; at 800 and 600 deg. C., when methane was present, the experimentally observed results were still in reasonable agreement with Sievert's law.

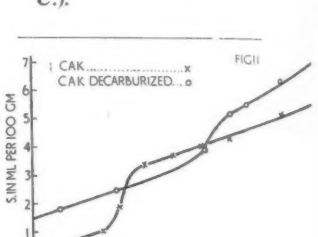




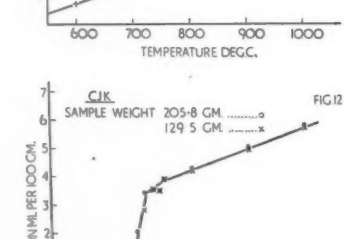
FIGS. 7 TO 9.—*Effect of temperature on hydrogen solubility;* FIG. 7.—*pure iron;* FIG. 8.—*ingot iron* (0.02 *per cent. C.); and* FIG. 9.—*mild-steel* (0.15 *per cent. C.*).

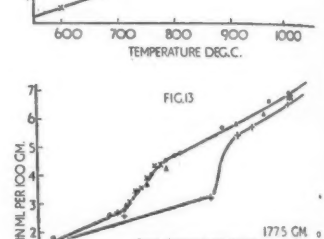






FIGS. 10 TO 13.—*Effect of temperature on hydrogen solubility of B.I.S.R.A. steels from* 0.28 *to* 0.99 *per cent.*





(*c*) *Cast Irons* (Fig. 6, Table II). A further variable was introduced in the case of cast irons—the formation of graphite. At the time of experiment the specimen used had already graphitized. The Sievert's law was again followed at 1,000 deg. C.

The results showed that for the carbon alloys investigated and over the temperature range of the determinations that the square-root law could be used to correct the experimental values to a standard pressure (hydrogen and methane) of 760 mm. Hg. without undue error.

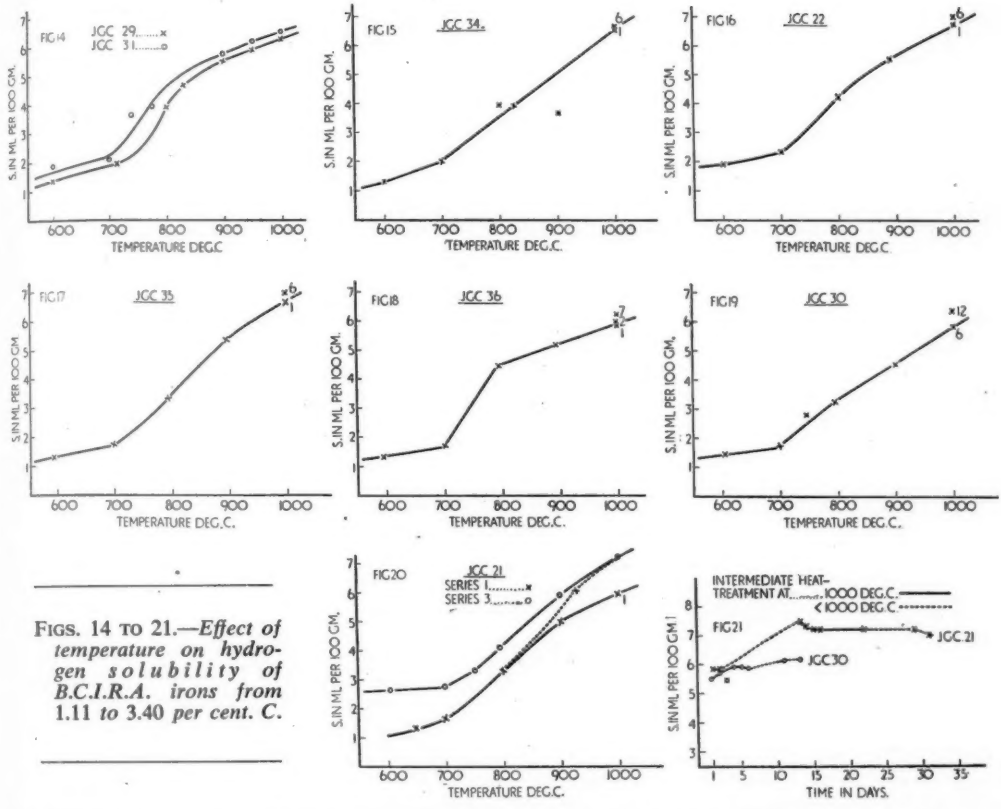
Effect of Temperature

(*a*) *Pure iron* (Fig. 7). The determinations with pure iron were carried out primarily as a check on the apparatus and methods used and to investigate the reproducibility of the results obtained. The values obtained by both the "absorption" and extraction methods agreed reasonably well with those quoted by Luckemayer-Hasse and by Schenck. A large and sudden change in solubility occurred at 900 to 912 deg. C., the A_3 point of pure iron.

(*b*) *Ingot iron* (Fig. 8). Small amounts of methane appeared in the gas phase. The change in solubility values occurred in the temperature range 885 to 908 deg. C., the critical range of the material. The effect of carbon on the solubility values was determined by complete decarburization of the specimen in wet hydrogen and the re-determination of the values by both the "absorption" and "extraction" method.

TABLE II.—*Solubility by Extraction. J.G.C.21. Effect of Pressure.*

Test No.	Day.	Soaking.			Hydrogen extracted.	Per cent. CH_4 in gas.	
		Temperature, deg. C.	Pressure, mm. of hg.	Time in hours.		From metal.	Soaking atmosphere.
12	18	1,000	765	4 B	7.3	—	3.5
13	19	1,000	167.5	16 A	3.85	11	4.5
14	20	1,000	121.5	4 B	3.6	11	5.0
15	21	1,000	54.5	16 A	2.0	12	6.0
16	22	1,000	773.5	4 B	7.35	—	3.5
17	23	1,000	493.5	16 B	5.75	—	4.5
18	24	1,000	327	16 A	4.65	—	5.0



FIGS. 14 TO 21.—*Effect of temperature on hydrogen solubility of B.C.I.R.A. irons from* 1.11 *to* 3.40 *per cent. C.*

(*c*) *Mild-steel* (Fig. 9). Appreciable amounts of methane were found to occur in the gaseous phase over the specimen, making the determinations carried out by the "absorption" method uncertain. The method was therefore not used for this, or the higher carbon content alloys. Values obtained by the "extraction" method showed that the sharp solubility change occurred over the range 725 to 825 deg. C. Decarburization of the specimen had little effect on the values obtained in either the α or γ states, but increased the temperature of the sharp change in solubility.

(*d*) *B.I.S.R.A. Steels* (Figs. 10 to 13). Increase in carbon content up to 0.52 per cent. gave a progressive lowering of temperature at which the solubility curve showed an increased rate of solubility. There was also evidence of a slight decrease in hydrogen solubility. With further increase in carbon content up to 0.99 per cent. there seemed to be an increase in solubility values. The 0.52 per cent. C and 0.99 per cent. C steels were therefore completely decarburized and the solubilities re-determined. This confirmed that there was a minimum value in hydrogen solubility as carbon content increased (Fig. 22). What evidence there was available suggested that this minimum occurred in a steel which was entirely pearlitic at room temperature, a condition shown to exist with the 0.52 per cent. C steel. This minimum value was most marked in the results at 900 and 1,000 deg. C. where the solubilities were greatest; the results at 700 and 800 deg. C. were confused by the structural changes which occurred in this temperature range. Unfortunately the precision with which this minimum could be fixed was obscured by the variations in alloying elements other than carbon which were present in this series of steels, typical of high-grade commercial products. It would have been better to have carried out the investigation with materials of the same high degree of purity as in the later work on pure iron/carbon alloys.

(*e*) *B.C.I.R.A. Pure Iron/Carbon Alloys* (Figs. 14 to 21 and 22). The results showed that in general, at temperatures below the transformation point, there was no marked variation in hydrogen solubility over a carbon content of 1 to 3.4 per cent. Within the entirely austenitic range, the solubility at any one temperature increased to a maximum value at 1.8 per cent. C at 1,000 deg. C., 1.6 per cent. C at 900 deg. C., and 1.3 per cent. carbon at 800 deg. C. Further increase in carbon content gave slightly lower solubilities. It must be realized, in quoting these values, that it was not possible to carry out determinations for any alloy of greater carbon content than 1.55 per cent. C in the completely austeni-

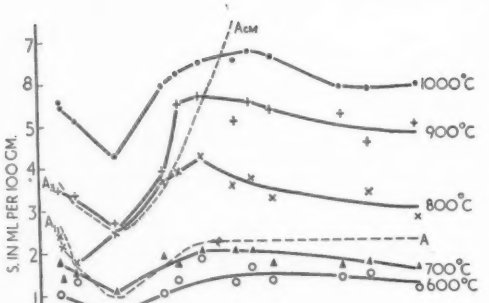


FIG. 22.—*Summary of data on the effect of temperature on hydrogen solubility.*

tic condition, even at a temperature of 1,000 deg. C.

3.4 *per cent. Carbon Alloy* (Figs. 20, 21 and Table III). The investigation of this alloy was made in considerable detail, since this alloy was found to graphitize during the solubility runs. Two determinations at 1,000 deg. C., after 4 hr. and 16 hr. saturation respectively give concordant readings. Determinations at 100 deg. C. intervals down to 600 deg. C. gave the normal type of solubility curve. A further determination at 928 deg. C. gave values which were in excess of the expected value. Metallographic examination of the specimen at this point indicated that the alloy contained about 1.5 per cent. carbon as graphite and had decreased in density. The specimen was therefore reheated at 1,000 deg. C. and repeated solubility determinations carried out until a steady value was attained. This treatment was found to give an increase of carbon as graphite to 2 per cent., accompanied by an increase in density. Solubility determinations carried out on this graphitized alloy gave results which were higher than the original at all temperatures. At the end of this series, the specimen had a graphitic carbon content of 2.5 per cent. and its density had decreased further. It could be deduced from these series of results that the solubility of hydrogen in a grey cast iron must be due to (*a*) solubility in the metal itself, (*b*) solubility in the graphite, and (*c*) occlusion in flaws and discontinuities in the structure of the specimen.

It would seem from the values obtained that the solubility of hydrogen in iron/carbon alloys of carbon content 0 to 3.4 per cent carbon are of the same order, over the temperature range studied, the values at 1,000 deg. C. being around 5 to 7 parts per million. There is evidence of a minimum at 0.55 per cent. carbon or thereabouts and of a maximum of 1.3 to 1.8 per cent. carbon according to temperature. Grey irons seem to have higher solubilities than white irons of similar carbon content, the difference being of the order of 1 to 1½ p.p.m.

Acknowledgments

The Authors wish to thank the Professor of Metallurgy at University College, Cardiff, for facilities to carry out this research; B.I.S.R.A. for samples of pure iron and commercial steels; B.C.I.R.A. for the preparation of the high purity iron/carbon alloys; and the Joint Gases Sub-committee of the Institute of British Foundrymen and B.C.I.R.A. for their continued support and interest in the work.

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[4] Thompson, *T.A.I.M.M.E.*, 1945, 162, 369.

TABLE III.—*Investigation of 3.4 per cent. Carbon Alloy J.G.C.21.*

Relative density.	Per cent. graphite.	Test No.	Day.	Soaking			Gas extracted.	Per cent. CH_4 in gas.	
				Temperature, deg. C.	Pressure, mm. of hg.	Time in hours.		From metal.	Soaking atmosphere.
7.79	0	1	1	1,000	776	4 B	5.25	11	3.5
		2	2	1,000	763.5	16 B	5.25	11.5	4.0
		3	3	900	753.5	16 A	4.45	10.5	6.0
		4	4	800	748.5	16 A	2.45	15	8.5
		5	5	700	777	16 A	1.45	17	6.0
		6	6	635	784.5	16 A	1.15	16	3.0
		7	7	928	788	16 A	5.5	10	4.5
27	1.5	—	8	Cooled down to room temperature in 12 hours: microsection taken at room temperature.					
		8–12							
		8	13	1,000	785	4 B	6.7	11	4.0
		9	14	1,000	799.5	16 B	6.6	—	3.5
		10	15	1,000	782.5	16 B	6.5	—	4.0
		11	16	1,000	770	16 B	6.5	11.5	—
7.52	2.0	—	17	Cooled down to room temperature in 12 hours: microsection taken. Re-heated to 1,000 deg. C. Effect of pressure. See Table II.					
		12–18	18–24						
		16	22	1,000	773.5	4 B	6.5	—	4.0
		19	25	900	745.5	16 A	5.25	10	6.0
		20	26	795	745	16 A	3.55	—	8.0
		21	27	745	767	16 A	2.9	—	—
		22	28	700	754.5	16 A	2.45	15	5.5
		23	29	1,000	779.5	4 A	6.5	—	—
		24	30	605	765.5	16 A	2.30	15	2.5
7.11	2.5	25	31	1,000	763.5	16 B	6.3	—	—

A = equilibrium approached by evolution of H_2. B = equilibrium approached by absorption of H.

American Developments in Plaster Casting

*By B. H. C. Waters, M.A., Ph.D.**

Introduction

Plaster casting is now in common use in the U.S.A. where close dimensional tolerances are required in castings of fairly low-melting-point material in association with a good surface finish. At present, probably the widest field of application is the use of the process in making aluminium matchplates, though it may also be used wherever precision surfaces are required in a low-melting-point metal. The use of air pressure on the metal being cast in a plaster mould is characteristic, though it may take the form of pressure applied centrifugally.

Special equipment used consists of suitable apparatus for applying the pressure to the metal during casting. Other ordinary foundry appliances are also needed. In matchplate casting, pressure is applied from a standard air line. Moulds are prepared by mixing suitable plaster with water, covering the patterns with a parting agent, pouring the plaster slurry on the pattern and allowing it to set. The plaster mould is then stripped and cast.

Plasters

A description of the plasters used in this process as practised in England has already been published.[1] In the U.S.A. similar processes and plasters are used, proportions of 50 per cent. plaster and 50 per cent. water being the approximate mixtures employed. There, as here, plasters of various types are available, some possessing expansion properties. In this way, wooden patterns designed for use with one material can be used as a basis for metal patterns of another material, the pattern allowances being achieved by adjustment of the setting characteristics of the plaster mix. A normal drying temperature for plaster is 200 deg. C., and a suitable drying time about 14 hours, the moulds often being left to dry overnight.

Re-usable Plaster

With the object of producing a plaster that may be re-used, a refractory has been developed which consists of a mixture of 30 per cent. plaster and 70 per cent. silica flour.[2] It is claimed that the re-use of this material helps to stabilize it and thus permit closer retention of tolerances. The material is mixed with 50 per cent. water, poured into blocks, and allowed to set. Subsequently these blocks are heated for three hours at 430 deg. C. At this temperature there is a limited reaction between the calcium sulphate (from the plaster of Paris) and the silica. The reaction forms calcium silicate, so that the final block consists of a mixture of silica, hydrated calcium sulphate, and calcium silicate. The blocks are subsequently broken up and crushed to a fineness of 300 mesh. This calcined material is then mixed with a mixture of 70 per cent. silica flour and 30 per cent. plaster of Paris as before, about 60 per cent. calcined material and 40 per cent. freshly-prepared material constituting the final mix. This is then used as the basis for making plaster moulds and cores. In making up moulds, mixing is done as before, the final plaster mixture from which the cores are made consisting of 66 per cent. dry mix and 34 per cent. water.

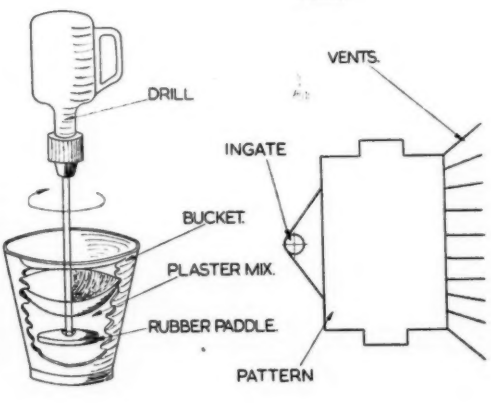
The mixing is very conveniently done in a bucket using a rubber disc attached to the end of a mechanical drill, as shown in Fig. 1. After stirring, the speed should be gradually reduced so as to give air bubbles a chance to escape. Plaster made up in this way has a setting time of approximately 5 to 10 min. Moulds made from it are pre-heated for about two hours at a temperature of about 300 deg. C. (read on the inside mould cavity face) before being cast.

Patterns

Pattern materials used for a plaster process depend on the type of casting to be made. For a cast plaster matchplate, the patterns are usually of wood, although sometimes other materials may be used. If, for instance, a component of the shape finally required is available, and it is smooth and has adequate draft on parting surfaces, then this may itself be used as the pattern from which the matchplate is to be produced. In this case, machining allowances are obtained by adjusting the plaster mix as already described. If plaster casting is used as a precision-casting process for producing an unusually good surface on a casting

FIG. 1.—*Simple paddle used for mixing a plaster slurry.*

FIG. 2. — *Diagram showing venting arrangements used in pouring a plaster mould.*



* The Author is now with William Jessop & Sons, Limited.

where large numbers are required, metal patterns for making the plaster mould are preferable to wooden ones on account of their durability. Cast iron is often used, or, if a pattern requires a good deal of hand work, Muntz metal may be employed. This is readily obtained sound and is easy to work. If copper-base alloys are used, they are generally chromium plated to give a hard, smooth surface.

A commonly-used parting agent is stearic acid in paraffin, having about 25 per cent. by weight of stearic acid in the mix. For metal patterns, where accuracy is usually an over-riding consideration, a film of thin machine oil is often used to facilitate stripping. The pattern is sometimes also coated with graphite and polished.

Casting Techniques

Temperatures used for casting aluminium matchplates vary with the section thickness to be cast. For a plate about $\frac{1}{4}$ in. thick, however, with no very thin sections, the temperatures used are below the liquidus, being of the order of 540 to 580 deg. C. for most of the aluminium alloys employed for this work. The procedure used is to fill the casting pressure cylinder with liquid metal at a low temperature, and then allow it to cool. While the metal is cooling it is stirred, and the moment for casting is judged mainly by the appearance of the metal. The metal is cast when the ratio of solid : liquid is judged to be about 1 : 2. This is probably a more accurate guide than temperature measurement, since the metal temperature may vary throughout the melt, though secondary control may be established by temperature measurements. Stirring is essential, otherwise the solid particles tend to segregate. The low temperature used is necessary to minimize casting shrinkage. Such shrinkage is also reduced by the pressurizing.

Metal thicknesses as low as $\frac{1}{16}$ in. may be pressure cast in plaster, but for sections below about $\frac{1}{2}$ in. higher casting temperatures than those quoted above are needed to prevent misruns. These temperatures are in the region of 600 to 620 deg. C. The temperatures quoted, however, are only approximate and refer to an alloy of the D.T.D.-424 type.

For centrifugal casting, still higher temperatures are customarily employed, the metal being cast much hotter than is usual even in ordinary aluminium practice. This is because of the different requirements in centrifugal castings and pressure-cast matchplates. Centrifugal castings ordinarily require considerable strength, which is not so necessary in a matchplate. Thus, in the former case, microporosity cannot be tolerated, while in the latter case a small amount of microporosity does not matter. For centrifugal casting, the alloy is superheated to 870 deg. C. for about 20 minutes, suitably fluxed, and is then allowed to cool to 820 deg. C., before pouring into the mould. Rotation of the mould commences as the first metal enters it. When casting about a vertical axis, as is usual, there is a steady metal build up at the sides, but there is no immediate gross splashing to the outer sides of the mould. This promotes a good surface since the danger of dross particles being flung to the side of the mould is minimized, and good feeding is ensured.

Pressures used in matchplate castings are of the order of 5 lb. per sq. in., applied from a standard, low-pressure air line. In filling the mould, cavity vents are provided on the side opposite the ingates as shown in Fig. 2. These vents are struck out horizontally, being cut in the plaster on the top of the dry surface and penetrating underneath the steel frame used to give thickness to the plate. Speeds used in centrifugal castings are 200 to 250 r.p.m. on a casting about 10 in. dia. This corresponds to outward acceleration of 8.8 *g*. Thus with a thickness of about 1 in. of metal, the surface pressure is 28.2 lb. per sq. in. This is of a similar order of magnitude to the pressures used in the aluminium pressure-casting process. Thus it will be seen that to produce the surface finish of which a plaster casting process is capable, the casting must be made under conditions of pressure as well as being cast against the smooth plaster surface.

Cleaning Plaster from a Casting

In the pressure-casting of matchplates, where no recovery of the plaster is attempted, it does not much matter what is used for cleaning, provided the casting surface is not damaged. When plaster is to be reclaimed, however, the plaster may possibly be removed with a water jet. This has the disadvantage of introducing water into the plaster mix and in production operations it would probably be necessary to remove the plaster in an autoclave by means of steam. For ordinary straightforward moulds, the cleaning operation would not be difficult. Re-entrant angles or cores on the surface of the casting would, however, present problems.

Tolerances

Tolerances claimed on this process with carefully prepared plaster are of the order $\pm$ .001 in. Such tolerances can, however, only be achieved by very careful plaster and pattern development. On ordinary pressure-cast matchplates the tolerances are much less close, being of the order of $\pm$ 0.015 in. on about 6 in. This means that pressure-cast aluminium matchplates are not suitable for use as shell-moulding patterns if it is hoped fully to exploit the possibilities of the shell-moulding process for producing castings to very close tolerances. The surface finish on plaster castings is, however, very good, being 30 to 100 r.m.s. units, when a plaster of No. 300 fineness is used.

A severe limitation on plaster casting arises from the temperatures which plaster can stand. Even when mixed with silica flour and calcined, the mould is not suitable for casting metals at temperatures above 1,100 deg. C. Thus, as it at present exists, the plaster casting process can only be used mainly for aluminium alloys, but further research indicates its increasing application to brass and

bronze casting. Recently, the Aluminum Company of America announced that they were making installations in all their foundries for the utilization of the plaster-casting process.

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Work-study Week-end

Henry Wallwork & Company, Limited, have increased their output of grey iron castings by some three times over the last five years, and "work study" has been used as one means of achieving this and at the same time of increasing productivity. The expansion taking place in the firm has meant that new staff have been engaged and for their benefit a week-end course in the principles of work study was held at Burton Manor College, a residential college for adult education in the Wirral, during the week-end of July 9 to 11.

The majority of the staff of the company, both technical and non-technical, and including a number of shop stewards, went to this training college for two days. Those members of Henry Wallwork's staff who have been trained in work study gave a series of lectures and demonstrations, including films, to illustrate the principles of work study which have been applied so successfully in their foundry in the past, and which will continue to be applied to produce further improvements in productivity. The course was organized to give the maximum opportunity for practical exercise by those attending in order to illustrate that work study is not a special subject designed for experts, but a subject capable of use by any thinking person in industry. Perhaps one of the most effective exercises was on coremaking, where a core was produced by a method and in a layout familiar in many foundries. The students were asked to revise the method and suggest improvements to reduce the time of its production without using any extra equipment but merely by better positioning of the work place and materials. They were able to halve the time of the operation.

The experiment of taking employees for a residential short course in preference to a course of instruction in the works was a very successful one and it is intended to repeat it for further courses in management training. The necessity of spreading knowledge of work study as widely as possible was considered so important by the managing director, Mr. C. M. G. Wallwork, that special arrangements were made to release all supervisors to attend the course, and as a further training measure, selected operatives in the works were chosen to act as supervisors of work being carried out during the Saturday morning while normal supervisors were away. Henry Wallwork & Company, Limited, are members of the Manchester panel of the British Productivity Council and invite any interested firm or body to apply for details of this course, which is considered to be a pioneer effort as far as the foundry is concerned.

SPEAKING at a meeting of the Tees-side Productivity Committee, Mr. A. J. Speakman, technical officer to the British Productivity Council, said that there must be incentives to increase output. Of the 12 to 13 million people employed in industry to-day, more than 9,000,000 were working on ordinary time rates without any form of incentive, he declared.

New Catalogues

Runways. Geo. W. King, Limited, Stevenage, Herts, have just issued a folder which describes and illustrates installations of runway systems installed in a number of industries, including the foundry. The cover carries perhaps too bright a colour scheme. It is available to readers on writing to Stevenage.

Beryllium in Light Alloys. From the Beryllium Smelting Company, Limited, 36/38, Southampton Street, London, W.C.2, a four-page leaflet which details the use of the metal beryllium in aluminium foundry practice. Additions of the order of 0.10 to 0.50 per cent. are cited. The pamphlet is available to our readers on application to Southampton Street.

Refractory Bricks. The Morgan Crucible Company, Limited, Neston, Wirral, Cheshire, have recently issued leaflets dealing with three types of brick. M.R.I. operates at temperatures up to 1,600 deg. C. and its properties are tabulated. The second, M.I.28, is a hot-face low heat-storage insulating brick, whilst the third, M.I.23, also is an insulating brick. Attractively produced, they are available to our readers on writing to Wirral.

Wax. Croda, Limited, Snaith, Goole, Yorkshire have issued data sheets concerning the properties of a new high-melting-point wax which they have introduced under the trade name, Crodura. Though primarily designed for use in polishing, postulated uses for the wax include its adoption as a mould lubricant when handling plastics and for lost-wax casting. Interested readers should write to Goole for a copy of the publication.

Insulating Concrete. The Morgan Crucible Company, Limited, Neston, Wirral, Cheshire, have recently issued a leaflet dealing with a new insulating concrete. The material is christened MI.22—so that is must be over four times as efficient as MI.5! Of major interest to foundries is its potential use as "gunning" material for repairing cupolas. Amongst its properties is a less than 1 per cent. contraction after firing to 1,200 deg. C. The leaflet is available on writing to the firm at Battersea Church Road, London, S.W.11.

Corebox Vents. From British Ronceray Limited, 14 Wolsey Road, Sheffield, 8, a leaflet has been received illustrating and describing a neat "gadget" to be inserted in the crucial locations of coreboxes used in connection with blowing machines. The construction is such that whilst air is allowed to pass, the venting is so fine that the sand is retained. Moreover, the slots are tapered, which goes far to make them self-clearing. The leaflet which illustrates the gadget quite clearly is available to readers on writing to the Sheffield address quoted.

Surface Pyrometers. Land Pyrometers Limited of Colonial Works, Queen's Road, Sheffield, 2, have sent us a leaflet which describes a radiation pyrometer of a new and interesting type. No emissivity corrections have to be effected as use is made of a concave gold plated reflector. When this reflector is placed on a hot surface, this aims its image in the reflector from the equivalent of a uniform temperature enclosure, giving practically black body conditions. The instrument has been designed in co-operation with the British Iron and Steel Research Association. This leaflet and a technical description are available to our readers writing to Sheffield.

Parliamentary

Financial Aids to Industry

When the Finance Bill was further considered at the report stage in the House of Commons, MR. HUGH GAITSKELL (Lab.) moved an amendment to allow, in the case of industrial buildings, an initial allowance to continue in addition to the investment allowance. He said that in committee the Chancellor had undertaken to review the point and it had been hoped he would put down an amendment. The Opposition considered it right that industrial building should be stimulated.

He could not see how anyone could argue that the small concession in the investment allowance, which would be enjoyed in 45 years' time, was likely to have any significant effect on the willingness of any industrialist to undertake new building. The Opposition's proposal would allow the initial allowance to continue, so that any industrialist who decided to erect new buildings would obtain the investment allowance at 10 per cent. and the initial allowance at the same rate.

MR. ANTHONY CROSLAND (Lab.) said the Finance Bill offered virtually no new inducement to industrial building, although a number of leading industrialists had emphasized the need for it. The relaxation of the building licence system had given industry the opportunity to build, and the Government ought to provide financial inducement as well.

MR. REGINALD MAUDLING, Economic Secretary to the Treasury, said that in accordance with the undertaking given in committee the Chancellor had again studied this question, but had decided not to make any change in the proposals as originally introduced into the Finance Bill. He asked Opposition members not to write off entirely the benefit of the investment allowance in respect of industrial building. To accept the amendment would make it more difficult to hold the line adopted between industrial buildings and commercial buildings, and the Chancellor was anxious not to give way here. The cost of accepting the amendment would be £4,000,000 in the first year and £7,000,000 in subsequent years.

The amendment was negatived by 263 votes to 230.

An amendment was moved by MR. CROSLAND to give to certain types of plant and machinery designed to save fuel an investment allowance of 25 per cent. instead of 20 per cent.

Even a small saving in coal was important because the country was working on such a narrow margin the whole time. One million tons might not sound very much, if that was the saving, but it might even make the difference between having a coal crisis and not having one. It might also make a difference of 5 per cent. in any one year in industrial output.

It would be a grave mistake, said MR. GERALD NABARRO (Con.), to try so soon after the inauguration of the Government's loan scheme and the fuel efficiency organization to alter the basis of encouraging and stimulating industrial fuel efficiency by changing to the type of incentives proposed in the amendment.

MR. MAUDLING said that undoubtedly the coal situation gave rise to concern, and coal should be used as economically as possible, but if tax concessions were allowed on machinery designed to save coal what about dollar-cost imports, petroleum for instance? It was a great problem to ensure payment for our imports. The introduction of fuel-saving plant was a good business proposition and was already encouraged by a Government loans scheme, and in addition there was now the investment allowance. In the circumstances the Government did not feel justified in giving a further discriminatory allowance.

The amendment was negatived by 262 votes to 224.

Moving the third reading of the Bill in the House on Monday, MR. JOHN BOYD-CARPENTER (Con.) said that the biggest change had been in the introduction of the new investment allowance. It would be wrong to assume that in the immediate future investment would necessarily show a spectacular rise, but he believed the allowance would contribute a great deal to producing an intellectual climate in which there would be far greater willingness and enterprise in investment, in that way assisting British industry in meeting the difficulties facing it. In was a matter of great satisfaction that the shipping industry would secure some real assistance from this provision.

MR. R. A. BUTLER, Chancellor of the Exchequer, said that with the present high level of employment we were now working much more up to our resources than we were a few months ago. With the index of production having risen we should have to look for further progress from increased productivity, which was now of the greatest possible importance. Exports had risen, in general there were no marked shortages, but we were now running up to the full load and it was therefore important to realize that further productivity, particularly in coal, was of the utmost importance to the future of our economy. We were living in a period of comparative prosperity, but should certainly make further efforts to sustain the advance already made.

He had been asked whether warning would be given if the rate of the investment allowance was to be altered. When the initial allowances were suspended warning was given that that would take place, and for ships already ordered or under construction special provisions were made. Such a respectable precedent would certainly be considered in the event of any alteration in the rate, but he was not contemplating any alteration of the sort that had been made before. They should now look further ahead and regard this not as an ephemeral matter but as one which had come to fortify the general system of encouraging initiative in industry. He hoped that industry would take advantage of the allowance.

Ministry of Materials to End

Sir Winston Churchill announced in the House of Commons recently that the Ministry of Materials was to be dissolved next month and its remaining work taken over by the Board of Trade. The Prime Minister said that a Draft Order in Council dissolving the Ministry and transferring its remaining functions to the Board of Trade from August 16 had been laid before both Houses of Parliament. He said that this step had been made possible and desirable by the progress which Lord Woolton, the Minister of Materials, and his predecessors had made in bringing to an end public trading in industrial raw materials.

By the end of this financial year the great bulk of raw material disposals would have been effected at fair market prices and without so far any serious disturbance to trade, said Sir Winston. Nearly 1,400,000 tons of materials would have been disposed of. The absorption of the Ministry of Materials by the Board of Trade would, of course, result in economies in administration as reorganization became effective.

THE HOME SECRETARY said he understood that the Council of Wales hopes to submit a report about the position and prospects of the Welsh ports this autumn.

Simple Foundry Expedients Proved Worthwhile in Recent Years*

By J. E. O. Little

(*Continued from page* 103)

Patternmaking Problems

For repetition work, using an impeller rammer, cast-iron patterns are the most serviceable, but the property of hardness which makes them so serviceable means that they take longer to finish in the patternshop. To obviate the need for much finishing work castings for patterns are now being produced in fine-finish moulds, and the joint is the only part being touched up before mounting (Fig. 16). The moulding sand used for making these moulds is of the order of 160 to 200 mesh and plumbago is added. Only a facing of this fine sand is used, the remainder of the mould being filled with a sand mixture of high permeability. The reduction in the cost of metal patterns made in this way is considerable, and what is perhaps more important, the time the foundry has to wait for the preparation of new metal patterns is very much reduced. Hand finishing of patterns has been almost eliminated.

An interesting case of using a modern idea in place of an older one is in the manufacture of the pattern for the end-frame of a rotary strainer. These strainers are made in two sizes, 7 ft. 6 in. and 10 ft. dia., and resemble a light, spoked wheel in which the panels between the spokes are filled in with metal $\frac{5}{8}$ in. thick. One side of the frame is formed by a flat top-part when moulding, and it was anticipated that the slightest buckle or deformity on this large flat area would look very objectionable when the machine was erected. It was decided, therefore, to make the panels with a "pebble" finish, or, in other words, deliberately produce irregularity all over. For the smaller machine, therefore, aluminium patterns were made for the panels, using a master pattern on which pebble-finish Lincrusta wallpaper had been stuck. This produced the desired result, but when the larger machine was considered it was thought that a much more pronounced pebble finish would look better. Unfortunately, wallpapers could not be found which had a bigger or bolder pebble design.

An attempt was made to cast a master pattern from actual pebbles held together by means of plaster of Paris. This was done by pouring the plaster on to pebbles arranged in a frame of the required shape, but a rather irregular distribution of the pebbles was obtained, because they tended to be washed out of position when the liquid was

* Presented at the fifty-first annual meeting of the Institute of British Foundrymen, held in Glasgow.

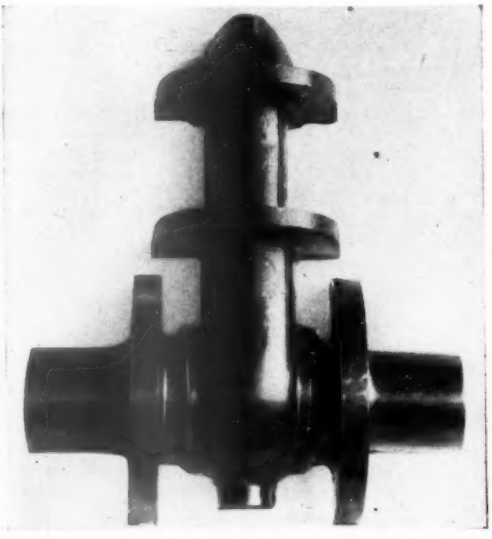


FIG. 16.—*Metal pattern with a fine finish as cast.*

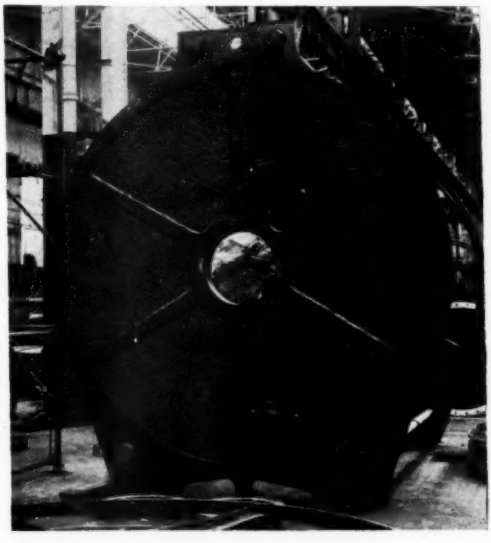


FIG. 17.—*Rotary strainer end frame* 10-*ft. dia., showing the pebble-finish panels.*

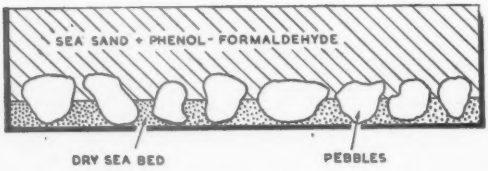


FIG. 18.—*Method adopted for making a pebble-finish pattern.*

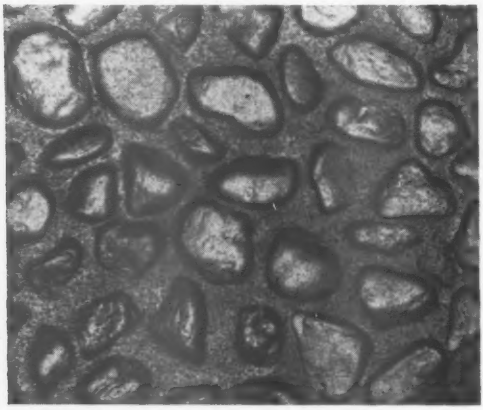


FIG. 19.—*Pattern surface for producing pebble-finish panels.*

FIG. 20.—*Champagne-glass type of dressing stool with the rotatable guard attached.*

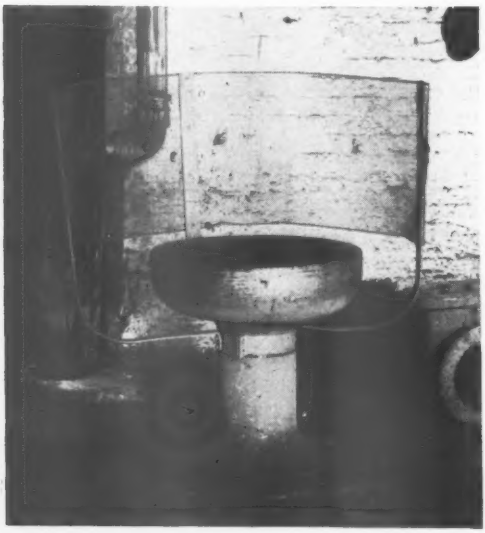


FIG. 21.—*General appearance of the dressing shop where the stools are used.*

poured over them. The idea of using plaster was therefore scrapped, and instead the pebbles were again put in the frame and a layer of sea sand $\frac{1}{8}$ in. deep was sprinkled over them to give a uniform filling of the interstices as shown in Fig. 18. Then, a 2-in. layer of a shell-moulding sand mixture was sifted on. The board and frame were then put in a low-temperature stove for six hours and a perfect cake of sand with pebbles embedded resulted. The $\frac{1}{8}$-in. layer of loose sand was then dusted off the face, the surface was painted (Fig. 19) and there was thus produced a master pattern from which to cast the aluminium patterns for use in the foundry. Fig. 17 shows a 10-ft. end-frame in course of erection.

Dressing Stools

In the dressing shop, stools are used instead of benches. These are hollow castings shaped like large champagne glasses and when filled with sand are extremely convenient to act as a work rest for the dresser. When production in the foundries was increased, it was found necessary to increase the number of dressers, and therefore increase the number of stools. As this brought them rather too close together it was essential to fit wire-mesh guards to prevent the man at the next stool being injured by flying chips.

The guards are $\frac{1}{4}$ in. mesh material, and are curved to the same radius as the stool. They are supported by brackets from the centre support of the stool in which a groove was machined to take a collar to which the brackets are attached (Fig. 20). This groove is kept greased and the collar just loose enough so that as the dresser works round his job he nudges the guard round with him. He is thus chipping towards the guard all the time, and does not need to keep turning the casting round to get at the job conveniently. The general appearance of the dressing shop in which the guarded stools are arranged is shown in Fig. 21.

FIG. 22.—*Hydraulic ram casting mounted on driven rollers and loaded internally with pig-iron for de-coring.*

FIG. 23.—*Tip-up ends of gravity conveyors, leaving a passage alongside the power conveyor.*

De-coring of Long Cylinders

Long rams and cylinder castings provide a tedious job when it comes to getting the core out cleanly, and this is especially troublesome if the bore is small in diameter. The dressing bars can, at the best, only strike a glancing blow at the adhering sand. To remedy this state of affairs, a set of four rollers was arranged, two of which were driven by a motor with a reduction gear, giving a speed of 6 r.p.m. A ram casting was arranged to rest on the rollers which caused it to rotate, whilst the inside was loaded with pig-iron (as is shown in Fig. 22), the pig-iron occupying some of the space from which the core-bar was previously withdrawn. For this method of de-coring no labour is required and the core is cleaned out perfectly. Usually a job after setting up is allowed to run all day without attention and when the pig-iron is tipped out no further cleaning is required internally.

Conveyor Safety

When a large number of roller conveyors are arranged to meet with a power-driven conveyor, inconvenience and danger arises to men requiring to move from one track to another. After a man had had his foot caught between the power conveyor and the end of one of these roller conveyors, tip up ends constructed as shown in Fig. 23, which are easily moved and ensure complete safety.

Tumbling Barrel

When cleaning smallish castings, the cheapest and simplest method is still by means of the tumbling barrel. Blakeborough & Sons Limited, have decided to continue the use of this plant, but have gone to some trouble of improving the design:—

Motive Power.—The barrel is mounted on trunnions, similar to a tube mill which thereby permits easy assembly and replacement of the barrel. It is driven by two 3-h.p. motor/reduction-gear units mounted below the floor in sealed-off dust-tight chambers, with a rocker adjusting gear for the Tex-Rope drive which turns the barrel by means of the well-known "Thrapston" method of drive, thereby saving expense of grooving the barrel for the Tex-Ropes and eliminating the risk of flash and metal getting into the grooves. This drive has been most satisfactory, the full current required for running normally loaded being 3-h.p. Two drives are adapted to maintain balance on the trunnions and to give the necessary starting and "inching" torque.

Barrel Construction.—The barrel is of box-

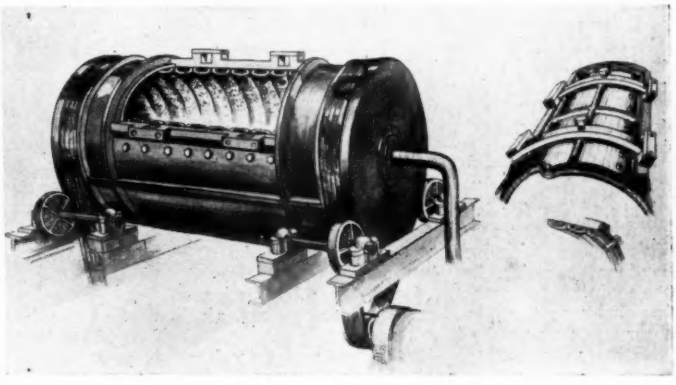


FIG. 24.—*Rumbling barrel, lined with old motor tyres, and with suction ventilation ducts at the central axis.*

FIG. 25.—*Old conveyor belting used for mould hopper sides.*

section design, heavily ribbed for strength, and the fixing of the door has been designed on the principle of the boiler manhole cover. The door is placed in position and two light transome fixing bars with jack screws are slid into location and the jack screws tightened by tommy-bar. The barrel is made out of balance by lead weights so as to bring the aperture to the correct position for filling and emptying.

Dust Extraction.—Dust and flash extraction is carried out by two 5-in. extraction pipes fitted in the centres of the barrel at each end. A suitable $\frac{3}{16}$-in. mesh sieve being fixed in a recess at each end of the barrel to prevent large chippings and core irons being drawn into the extraction pipes. The suction pressure used is $1\frac{1}{2}$-in. water gauge, which keeps the barrel free from dust and no dust arises outside the machine. This dust extraction has resulted in a much cleaner casting, especially in the cored portions.

Noise Reduction, Maintenance and Improved Casting Finish.—In order to improve the casting finish, it was considered that lining the barrel with a resilient material would be beneficial to casting finish and the life of the barrel. Trials were made using disused heavy-construction conveyor belting and the results anticipated were achieved, but the life of this lining was short. It was considered that a hard rubber, backed by canvas material, was required, and this idea was carried through, in a cheap and effective form, by utilizing disused (smooth-tread) lorry tyres with the tread facing inwards; the concave portion towards the barrel face, thereby giving the resilience required (see Fig. 24). A barrel of this type has now been running night and day for four months and the tyre treads nearest the door are just showing signs of wear. This rubber lining has not only eliminated the objectionable noise, but has considerably lessened the maintenance work on the machine by eliminating shock on the trunnions and bearings, and also wear and tear on the barrel and the door.

Factory Regulations.—By having adequate dust extraction within the barrel itself, the usual totally enclosed dust-cover or cabinet, as an independent unit, has been eliminated, thereby saving space. The complete machine is now fitted with a strong wire-mesh screen, with folding doors, thereby enabling the barrel to be under observation when running. The Tex-Ropes, door fasteners and door lifting bolts are designed so as to protrude as little as possible so as to eliminate revolving projections, and, as mentioned, the door is arranged by balance to come to the correct position for filling the barrel with castings without propping or "scotching," also the machine is silent running and well-balanced.

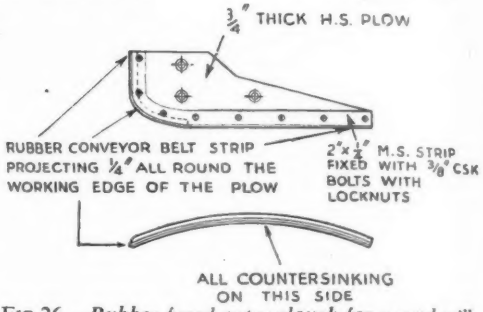

¾" THICK H.S. PLOW
RUBBER CONVEYOR BELT STRIP PROJECTING ¼" ALL ROUND THE WORKING EDGE OF THE PLOW
2"x½" M.S. STRIP FIXED WITH ⅜" CSK BOLTS WITH LOCKNUTS
ALL COUNTERSINKING ON THIS SIDE

FIG 26.—*Rubber-faced outer plough for a sand mill.*

Sand Plant

Another item which comes from the foundry of Blakeborough's is a sand storage hopper. These items are notorious for sand sticking and the usual method of releasing it, if vibrators are not fitted, is to hit the sides of the hopper with a rammer or other handy tool. The hopper shown in Fig. 25 is an otherwise orthodox type of hopper which has had its metal sides removed and replaced with disused conveyor belting. The sand flows easily from this hopper throughout the whole day, with no help other than a hand push at the lower part from the operator. The cost of maintenance is reduced, and unsightly damage to the hopper sides is eliminated.

Another valuable development concerns the ploughs for an Augusts' "Simpson" type of sand mill. The very rapid wear on ploughs had been reduced by substituting cast iron for these, in place of steel, and tipping the ploughs with hard steel had also been tried, but in any case wear was still quite serious. More recently, the ploughs were altered so that a rubber strip cut from old conveyor belting would act as the rubbing face, as is shown in Fig. 26. This has improved plough "life" from four days to three months, and after this period it is only necessary to renew the rubber.

Conclusion and Acknowledgment

The notions quoted in this Paper represent those deemed interesting from only two foundries, and if a compilation could be made from a much larger number of foundries, such a mass of useful hints would be available that the compendium would be a valuable asset on any foundryman's bookshelf. The writer is indebted to Glenfield & Kennedy and J. Blakeborough & Sons for the facilities to make up this Paper.

International Foundry Congress

Florence, September 19 to 26

The International Foundry Congress is this year to be held from September 19 to 26 in Florence. Amongst its features are the following:—

Artistic Exhibition of Subjects Inspired by the Foundry. International exhibition of paintings, sculptures, drawings and engravings inspired by the foundry.

Historical Exhibition. Objects of art illustrating the evolution of foundry from pre-historic times to present day (organized by the *Centro Storia della Metallurgia*).

Exhibition of Prints and Techniques of the Foundry.

Didactic Exhibition. Documents on the teaching of foundry practice in the different countries.

Exhibition on Foundry Defects. Under the patronage of the International Committee for Foundry Defects.

An Exhibition of machinery and raw materials for foundries for Italian firms and firms represented in Italy, organized by *Amafond-Assomet-Assider-Campfond.*

Italian associations have also organized in the locale of the congress a competitive exhibition of productions of the Italian foundry industry.

Congress Headquarters

The congress activities will be centred in Florence at the premises of the *Ente Autonomo Mostra Mercato Internazionale Dell'Artigianato,* Piazza della Liberta. The congress offices will be opened at the headquarters on September 1. Opening and closing ceremonies will be held in the "Palazzo della Signoria" (Palazzo Vecchio) in Florence.

Important. Participants who have sent in time an application form will receive at their respective hotels an envelope containing:—(*a*) advance copies of the Papers to be presented; (*b*) a "guide" of the congress and exhibitions; (*c*) a tourists' guide to Florence and Tuscany; (*d*) the congress badge; (*e*) a registration card and (*f*) tickets for the various events for which application has been made.

International Committee Meetings

Wednesday, September 22

3 p.m.—Foundry Dictionary Committee.

4 p.m.—Foundry Defects Committee.

Thursday, September 23

3 p.m.—Committee on Testing Methods,for Cast Iron.

4 p.m.—Foundry Technical Associations.

General Programme

Sunday, September 19

The registration office will be open from 10 a.m. to 12 and from 3 to 5 p.m.

5-7 p.m.—Tea by invitation of *Centro Fonderia dell' Associazone Italiana di Metallurgia* in the tea-room of the Congress Hall; dinner at hotel.

9 p.m.—Optional visit to the Uffizi Gallery.

Monday, September 20

9.30 a.m.—Official opening of the congress.

12.30 p.m.—Brief sightseeing tour of the city.

3-6 p.m.—Technical sessions.

5.30 p.m.—Reception of the official delegations at the Florence Employers' Association—Via Valfonda, 9.

Evening free.

Tuesday, September 21

9.30 a.m.-12.30 p.m.—Technical sessions.

2.30 p.m.—Tour of the city and surroundings (optional and by booking) motor-coach and guide service or visit (optional) to the Nuovo Pignone works, S.p.A. (foundry).

9.30 p.m.—Communal theatre; symphony concert.

Wednesday, September 22

9.30 a.m.—Technical sessions, all day, or . . .

2 p.m.—Members and ladies may take part in a combined visit to the museums and galleries of Florence, including Uffizi Gallery, Medici Chapels—National Museum (Bargello), National Museum of the History of Sciences; and Archeological Museum.

Thursday, September 23

9.30 a.m.—Technical sessions or . . .

8.30 a.m.—Excursion to Siena, and San Gimignano.

Friday, September 24

9 a.m.-12—Technical sessions or excursions *viz.*,

(1) Tour of the works of Fornaci di Barga (Lucca) of the S.M.I., (limited to 100 foreign visitors).

(2) Tour to the industrial zone of Apuania (members) including visits to the coke-ovens of the Soc. Cokapuania, to the foundry of Societa Termomeccanica Italiana and the naval dockyard, returning to the hotels in time for dinner.

Saturday, September 25

9 a.m.—Technical sessions, with, at 4.30 p.m., the closing ceremony at the *Salone dei Ducento* in the Palazzo Vecchio (Town Hall) and presentation of awards.

9.30 p.m.—Official dinner at the Grand Hotel (evening dress) followed by dancing.

Post-congress Tours

There are four post-congress tours, all leaving Florence on Sunday September 26.

Northern Tour. The first goes to Rapallo, where the night is spent and then on Monday morning, the trip is continued to Genoa, arriving at 10 a.m. There, a visit will be made to the San Georgio works, makers of electrical plant, and to the steel and iron foundries of Ansaldo. On Tuesday, about mid-day, the tourists arrive in Turin, where the F.I.A.T. motor-car works and the foundries will be visited. On Thursday, visits to the Olivetti works at Ivrea—amongst the most interesting plants in the country for foundrymen and engineers. Alternatively, the members can visit the works of Soc. Nationale Cogne, a steelworks and foundry.

Rome Tour. This tour, of a purely sightseeing character, to Wednesday includes an audience by the Pope.

Milan Tour. This party will arrive in the city at about 9 o'clock on Sunday night. Next day, there are visits to the Milan Steel Foundry Vanzitti and the National Technical Museum. Tuesday afternoon at 2.30 there is a visit to Pavia, where the Vittoria Mecchi malleable foundry will be seen. On Wednesday morning, the works of Falck, where there is an extensive research department, will be visited. Thursday visits to Navara, where a light-alloy experimental station is to be inspected. The tour concludes with the return to Milan.

Venice Tour. Arriving at Venice at shortly after 9 p.m. on the Sunday evening, two days will be spent in sightseeing. Milan will be reached by 9.45 p.m. The next day (Wednesday) there are morning visits to the Milan Steel Founding and the National Technical Museum, and an afternoon trip to Pavia to the Necchi foundry. The morning of the last day (Thursday) will be spent in Brescia where the S. Eustachio works will be visited. After a return by motor-coach to Milan, the tour ends.

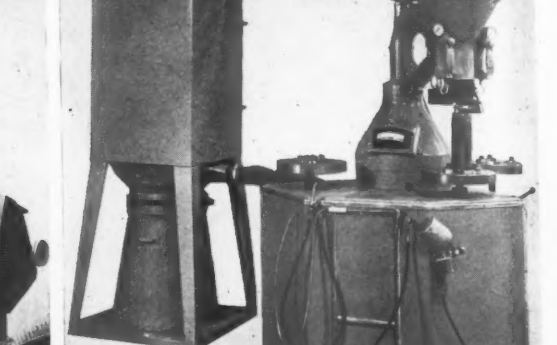


FIG. 1.—*Polygram Model VIII E. mass-production shell coremaking machine.*

FIG. 2.—*Three-station shell core machine and sand supply system.*

FIG. 3.—*Polgram double-station shell-moulding machine, with central investment box.*

FIG. 4.—*Mark XI shell core machine—a model designed for batch production.*

FIG. 5.—*Removable-drum mixing machine for resin sands.*

New Equipment

Shell Moulding and Coremaking Machinery

More and more, the Polygram Casting Company, Limited, Power Road, Gunnersbury, London, W.4, are devoting their efforts towards the design and manufacture of machinery adapted to the needs of shell-moulding. Recently an exhibition was held at the works to demonstrate their latest productions. For coremaking, three machines have been produced. They have been christened Mark VIIIE., IX and XI (though the writer would prefer that they could be given real names which could more easily be remembered). No. VIIIE, shown in Fig. 1 is a mass-production unit. A table has two stations, each of which holds a corebox, which is pneumatically opened and closed and heated electrically. The cores are thus cured on site. An easy cycle is provided by bringing a rotatable head over the box and filling it with the sand/resin mixture by push button. After a dwell time of a few seconds, the pressing of a second button, puts the operation in reverse and the excess sand is evacuated. By the time the second corebox is similarly treated, the first can be stripped, the resultant core being ready for insertion in either a green-sand or a shell-mould.

The second machine, shown in Fig. 2, has three adjustable tables, the height of which can be varied to suit the depths of three differing boxes. In this case, the coreboxes are heated in a separate oven. The blowing head fills and evacuates one of the three boxes which is returned to the oven for curing. Then the second is similarly treated, and so on, ensuring a continuous cycle. Coreboxes to a height of 24 in. can be accommodated.

The third machine, mark XI (Fig. 4) is of a simple character. Here, a heated corebox is placed beneath the head and secured by means of a clamp. A foot pedal admits the sand/resin mixture, a dwell time is allowed for curing, then the box is released and the excess sand returned to the machine through the grating provided.

Shell-moulding Machines

Amongst the shell-moulding machines on exhibition was Mark VIE which is characterized by the elimination of springs as will be seen from Fig. 3, the pattern is heated by electric elements. After being sprayed, the pattern is pneumatically rolled over to the dump box, the whole being manually turned over for investment. Then the parts are returned to the previous position and the pattern to its first position, when the oven is lowered for curing, during which time, a second mould is made. Following curing, the oven is raised and the shell stripped from the pattern by the use of pins.

Amongst other machines shown was a mould-closing device, which makes use of rubber diaphragms. These allow of a pressure of 15 lb. per sq. in. to be evenly placed on the two half moulds so that the adhesion between them will be effective. A second piece of equipment was an oven designed for heating the top half mould and to control the temperature to within ± 10 deg. C. regardless of the time of heating. Moreover, it ensures that a shell cannot be removed until the correct temperature has been attained.

As the blending of sand and resin is, with increasing outputs, becoming of greater importance, a simple machine has been designed for this which is dust-proof. It consists, as will be seen from Fig. 5, of a drum with a quick-action closure, carrying internally an agitator assembly. After mixing, the drum and contents can be carried to the point of usage.

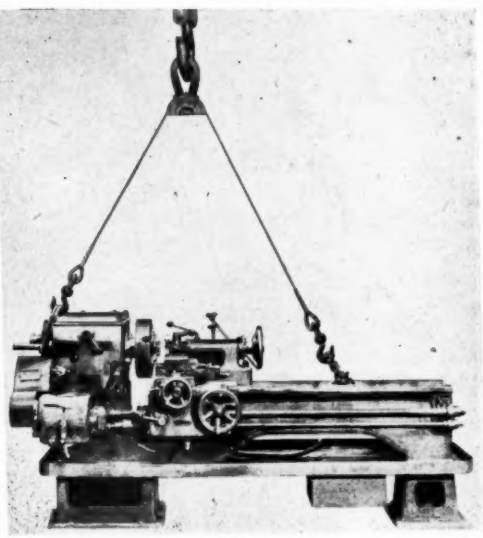
Finally, there was shown a simple yet effective apparatus for the reclaiming of used shells. These are charged into a cylindrical container supported by three legs. A closeable hopper is provided for the introduction of the shells and at the base an opening for the insertion of a burner. Once the shells have been lighted, the burner is withdrawn; the charge provides its own fuel, so that the process is continuous, and the powdered sand leaves by perforations in the base to fill a container. The output from this plant is of the order of 1 to 1½ cwt. per hour.

This range of machines is available for inspection by readers on application to Power Road. Moreover, a catalogue has been issued which illustrates, describes and gives the specifications of the equipment now available.

Adjustable Slings

Felco Hoists, Limited, at the Mechanical Handling Exhibition held recently, featured patented short head-room, light weight-lifting appliances, comprising hand-operated pulley blocks, electric chain and wire rope pulley blocks. Particularly of interest to founders were the equalizing and adjuster slings (for the safe handling of unbalanced loads) (shown in Fig. 6); overhead travelling trolleys and travelling chain blocks. On the outdoor stand, the firm's power-operated lorry loader was to be seen, which is designed for rapid on and off loading of drums, barrels, and the like. This unit can be fitted to most types of lorries and automatically stows away underneath the lorry.

FIG. 6.—*Felco "Adjust-a-leg" equalizing sling which can eliminate the need for special slings.*

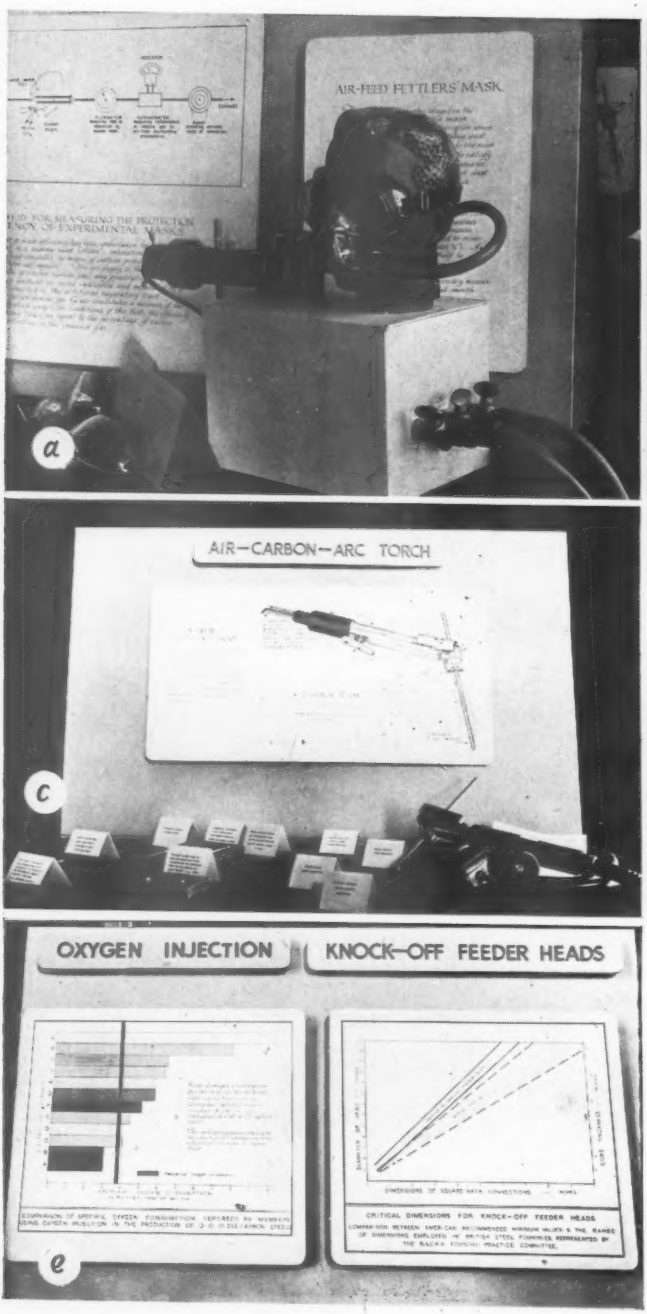


RENSHAW FOUNDRY LIMITED—MR. W. T. MORTON, F.C.C.S. AND MR. G. K. SMITH have been appointed directors.

BELLISS AND MORCOM, LIMITED—MR. E. L. MORCOM has relinquished his seat on the Board and MR. ALFRED MORCOM has been appointed an additional director.

EDGE TOOL INDUSTRIES, LIMITED—Mr. J. L. Ashford and Mr. J. T. Connor have been appointed to the Board. Mr. Connor retains his position as secretary.

B.S.C.R.A. Exhibition Features



Photographs of models and show-card illustrations taken at the exhibition held recently by the British Steel Castings Research Association.

(*a*) "Albert," a working model to prove the efficacy of a respirator. Development of the B.S.C.R.A. protective device has been completed and test and approval by the Factory Inspectorate is awaited.

(*b*) Production model of the rotary metal-sampling machine (see JOURNAL, October 22, 1953).

(*c*) Air-carbon arc fettling torch developed by the Association. The exhibit included a model of the torch and an example of the gouging produced on a steel casting.

(*d*) Scale model of the B.S.C.R.A. swing-grinder dust-control system.

(*e*) Exhibits embodying the Association's findings and recommendations in respect of oxygen-injection melting and knock-off feeder-head practice.

B.S.C.R.A. Exhibition

At the first annual meeting of the British Steel Castings Research Association, there was organized a small, but extremely interesting, exhibition designed to show visually to members just what had been and was currently being done for their benefit. The exhibits showed quite clearly that activities were being directed towards the reduction of industrial diseases; the provision of useful, immediately applicable apparatus and long-term researches. Into the first category enters the well-known work of Association in the development of dust reduction when using stand- and swing-frame grinders. Apparatus for the latter was shown in action as a tiny working model. Then there was " Albert "—a model which demonstrated the potentialities of a mask for people employed in dusty environments. It was an innovation created by Mr. Richardson of Brown, Lennox & Company, Limited, and his metal prototype was shown. From this has been developed a Perspex mask, carrying a slightly above normal pressure air supply. With nose breathers, this was claimed to give a 100 per cent. protection and a very high percentage also for those who unfortunately use their mouths for breathing. An ingenious contraption, involving a light beam, demonstrated that " Albert " was adequately safeguarded. Entering into this field, and also into the second, was the air/carbon-arc torch—a new tool which both eliminates dust and provides efficient means for gouging-out defects. Amongst other developments shown was a set-up for disclosing cracks, making use of a dye. It is equally applicable to non-magnetic steels and incidentally to cast irons also. Some work has been done on the substitution of the conventional linseed oils by shark oils. This is a worthwhile piece of work to bear in mind in case of national emergency, when linseed becomes both expensive and in short supply.

A long-term research showing the use of isotopes to investigate freezing phenomena was shown by charts. This work has so far underlined the importance—already known to be worth consideration—of convection. The metal/sand interface reactions was shown in one exhibit as a part of a series of interesting researches being carried out for the Association at Cambridge University by Dr. Hoar and his associates. At the annual meeting, over which Mr. C. H. Kain presided, Dr. J. F. B. Jackson, the director, gave a detailed report on the year's working. It was announced that a Grant in Aid had been offered and accepted from the Department of Scientific and Industrial Research. At the moment, the industry itself provides £40,000. A fully equipped foundry experimental station is to be constructed on a site in Sheffield.

Story with a Moral

There is a good story in a recent edition of the *Journal d'Informations Techniques des Industries de la Fonderie* of a foundry accepting an order for 30 pulleys—pattern to be supplied by the customer. Having a mechanized plant, a favourable price was accorded by the founders, but when they received the pattern—a simple strickle board—they objected. The moral of this story is given in a postscript which announces the forthcoming publication of a brochure by the *Centre Technique* dealing with the choice of patterns to suit the type of moulding and the relationship between the customer, the patternmaker and foundry.

Personal

Mr. THOMAS GRIFFITHS, joint secretary of Richard Thomas & Baldwins, Limited, is retiring this month after 46 years' service.

MR. R. T. REDFERN, managing director of the Bryan Donkin Company, Limited, of Chesterfield, has returned from a seven-week business trip to Canada.

SIR GEORGE EARLE, chairman of Associated Portland Cement Manufacturers, Limited, has been elected president of Aims of Industry, Limited, the industrial educational organization, in succession to the late Lord Lyle of Westbourne.

MR. RICHARD P. LAYFIELD, works manager of Thorn Holcroft & Son, Limited, makers of builders' castings, Wolverhampton, has retired from that post, but retains his seat on the board. He was presented by Mr. R. Chambers, shop foreman for 50 years, with a portable radio set on behalf of the employees.

THE HONORARY DEGREE OF LL.D. of the University of Wales was conferred on Sir Arthur Smout on July 20 in recognition of his work for industry in South Wales and of his contribution to technological education. Sir Arthur Smout is a former director of I.C.I. and a past president of the Birmingham Chamber of Commerce.

MR. RICHARD P. LAYFIELD, works manager of Thomas Holcroft and Sons, Limited, Wolverhampton iron-founders, has retired. Although he is leaving Wolverhampton to live in Bournemouth, Mr. Layfield is retaining his seat on the Board. Mr. R. Chambers, shop foreman for 50 years, presented him with a radio set on behalf of the firm's employees.

Three senior members of the staff of William Jessop & Sons, Limited, steelmakers, of Sheffield, Mr. H. W. ORAM, manager of the " old " forge department, Mr. HERBERT BOOKER, assistant manager of the same department, and Mr. JOSHUA PARKIN, foreman of the heat-treatment department, are retiring at the end of this month. Mr. Oram has been with the company for 51 years.

Among nine British scientists who have been nominated to take up research fellowships in American institutions under the technical assistance programme sponsored by the United States Foreign Operations Administration are Dr. R. B. COLES, Lecturer in Metal Physics at Imperial College of Science and Technology, and Dr. R. F. EVANS and Dr. V. A. KNIVETT of the Chemical Research Laboratory of the Department of Scientific and Industrial Research.

MR. J. D. THORN has taken up the post as chief engineer, Engine Department, Ruston & Hornsby, Limited, from July 19. He succeeded Mr. I. Wans, who has resigned from the company. Mr. Thorn has been in the Research Department of the company since 1946, and was appointed Deputy Chief Research Engineer in 1947, and Chief Research Engineer in 1949. He retains control of research and development in addition to new responsibilities in engine, locomotive and pump design.

Latest Foundry Statistics

According to the British Bureau of Non-Ferrous Metal Statistics the output of copper base castings for the first five months of this year was 26,391 tons as against 19,517 tons for the same period in 1953. For May the figure was 5,204 tons.

News in Brief

THE TWENTY-EIGHTH Annual Congress of the *Association Technique de Fonderie* will be held in Paris from June 2 to 4, 1955.

WILLIAM JESSOP & SONS, LIMITED, Brightside Works, Sheffield, are to instal a plant for the production of titanium and its alloys.

BIRLEC, LIMITED of Birmingham announce a new standard type of electric heat-treatment furnace to which they have given the type name R.S.

STANTON IRONWORKS, LIMITED, Ilkeston, Derbyshire, were visited on July 19 by five journalists from the Far East who are touring this country as guests of the Colonial Office.

THE AUSTRALIAN (VICTORIA) branch of the Institute of British Foundrymen last month had an evening visit to the works of the Australian Paper Manufacturers, Limited, Fairfield Mill.

THE INSTITUTION OF CHEMICAL ENGINEERS has issued a booklet detailing the regulations for the admission of student, graduate, and corporate members, and for the examination of the Institution.

THE HARRY PAYNE TRUST and the firm of Harry Payne, Limited, have endowed a Grade 1 lectureship in "Employer-Employee Relations" at Birmingham University in the Faculty of Commerce and Social Science for a period of seven years.

MR. VINCENT JOBSON, chairman of Qualcast, Limited, Derby, informed employees that a record year's trading had been completed by the Group; this included tonnage, output of finished products, profits and wages paid.

BRUSH ELECTRICAL ENGINEERING COMPANY, LIMITED, announce that Mr. L. C. W. Turner has been appointed sales director as from September 1. For the last 22 years Mr. Turner has been on the staff of Crompton Parkinson, Limited.

ON JULY 21 the "Derby Evening Telegraph" issued a career supplement for boys and girls which was a guide to opportunities in industry. Among the subjects covered were engineering, moulding, pattern making, mechanical and foundry engineering.

THE *Syndicat Général des Fondeurs de France* (The French foundry employers' federation) are publishing a set of ten volumes "Cours elementaire de Fonderie" for the use of students and apprentices. Already six have been issued; the seventh is two-thirds finished and the other three will be ready in two years time. The books have been prepared by Mr. H. Coste, and details are available from the *Groupment d'Achat des Fondeurs de France*, 2 rue de Bassano, Paris (16).

FOUR IRON GIRDERS weighing 30 tons each carrying the old Nottingham City and Suburban railway line (now disused) over the Lincoln-Nottingham line, were taken down and cut up for removal on July 18. The bridge was built in 1889 but closed to passenger traffic in 1923 and to freight traffic in 1941 after being damaged by bombs.

THE GEO. SALTER cricket team (West Bromwich) has won the Mayor of Oldbury's Charity Shield, defeating by four wickets the Chance & Hunt team who have won the shield eight times since it was first presented in 1942 by Councillor Mrs. C. T. Barlow. The shield was presented to the victors by the Mayoress of Oldbury, Mrs. Beard.

MR. C. E. T. CRIDLAND, the newly-elected president of the Scientific Instrument Manufacturers' Association, has announced that the association will hold an electronics symposium and exhibition at the Birmingham Chamber of Commerce from November 23-25, the first it has organized outside London. Last year the scientific instrument industry earned for Britain more than £20,000,000 in foreign exchange.

THE *Ecole Supérieure de Fondeurs* (Paris Foundry High School) is to be rehoused in the outskirts of Paris at Bagneux. The building will be on two floors surmounting a basement. The main hall, on the ground floor, will hold 60 students—the maximum for each year—above it is the drawing office. Provision is being made for a series of laboratories on both the ground and first floors stretching along one side of long corridors and space is reserved for future extension should this prove necessary.

RANCO, LIMITED, Scottish subsidiary of an American company manufacturing automatic temp. controls, are to vacate their factory at Newhouse Industrial Estate, near Glasgow, and expand production in a larger Government-financed factory to be built near Bellshill. On the new site the company will be able to increase their floor space from the 100,000 sq. ft. the new factory will occupy to the 400,000 sq. ft. they may require in 10 to 15 years. The present factory occupies 40,000 sq. ft. and 300 workers are employed.

MIDLAND SILICONES, LIMITED have recently held their first travelling exhibition at Nottingham where over 800 people saw, for the first time in this country, the wide range of silicones now available to British industry. Many working models were on view to demonstrate the properties of these materials, and exhibits from manufacturers in many branches of industry served to illustrate the uses of these new materials. Future plans for the exhibition will provide for visits to Manchester and Birmingham towards the end of the year.

AT A MEETING of the committee of the Midland section of the Institute of Vitreous Enamellers the 1954-55 programme was agreed to include the following subjects:—Rubber-lined Mills: their use to the industry (by R. W. H. Bennett); a paper by Mr. Golding: High-density Grinding Balls: (by G. Laugharne); a paper on current mill-room practice, and one on Safety in the Mill Room (by Miss K. Crundwell, H.M. Superintending Inspector of Factories, West Midlands Division). For social events there are to be a theatre party and dinner.

STUDENT APPRENTICES acted as guides when visitors toured the shops, offices, and the research laboratories at an "Open Day" at the English Electric Company's works at Stafford, when nearly 3,000 people saw this company's activities, and the products they manufacture. Mr. J. K. Brown, director of research, and Mr. J. R. Sully, general manager of the Stafford works, in a letter of welcome, expressed the hope that the "Open Day" would help visitors to "capture something of our love of engineering and of our pride in the products, and also in the name and reputation of English Electric."

CHURCHILL-REDMAN, LIMITED, Halifax, announce that the separate premises which the firm operated as an iron foundry, and known as Longfield Foundry, Parkinson Lane, Halifax, have been closed down. Due to the

extremely heavy demand for their range of machine-tools, the decision was taken to purchase their requirements of iron castings and to convert the foundry premises to an engineering works. Accordingly, production of castings ceased at the end of March, structural alterations were put in hand, and plant is now being moved in so that in the course of a few days the Longfield premises will be operating as a machine shop.

MATTHEW SWAIN, LIMITED, ironfounders, of Newton Heath, Manchester, have made presentations for long service to their employees. The presentations were made by Mr. Matthew Alec Swain, chairman of the company, at a luncheon on the occasion of the firm's annual works' excursion to Scarborough, when 200 employees were the guests of the firm. Employees who received presentations for long service were:—W. Blair (50 years), T. Quinn (50 years), M. Dawson (40), W. Gibbins (35), J. H. Ashton (30), J. A. Coop (30), C. E. Norman (25). Presentations to Mr. Blair and Mr. Quinn, who had completed 50 years, were also made by their fellow workers.

MORE THAN 1,000 workpeople are employed at the Willenhall factory of John Harper & Company, Limited, Albion Works, on producing castings, but only one in 100 have the opportunity of seeing their products attractively finished, since the final processes are often undertaken by customer firms, the last most employees seeing of their work is when articles are despatched in their rough casting stage. On Friday last the management opened a small exhibition for the workers, showing what eventually happens to the castings. On the stands were domestic appliances, typewriters, pieces of electrical equipment, car components, sections from marine machinery, and parts of agricultural implements.

THE BRITISH ELECTRICITY AUTHORITY'S new 300,000-kw power station, now under construction at Marchwood (Hants) is to be equipped for dual firing on oil or coal. This is the direct outcome of an agreement about to be concluded between the Esso Petroleum Company, Limited, and the B.E.A. for an estimated quantity of some 350,000 tons of fuel oil annually, to be supplied to the new station direct from the Esso refinery at Fawley. Ultimately the rate of consumption could reach a figure of nearly 600,000 tons of oil, equivalent to an annual saving of approximately 1,000,000 tons of coal. Marchwood, one of the largest of the 33 new power stations included in the B.E.A.'s current programme of expansion, is expected to come into operation during 1956.

AN EDINBURGH MAN who contracted pneumoconiosis through inhaling siliceous particles from sand and dust in his work as a steel dresser has been awarded £2,000 damages against his employers, Bonnington Castings, Limited, of Bonnington Road, Edinburgh, in a judgment by Lord Wheatley in the Court of Session. John Harkness Wardlaw claimed £5,000 from the firm, with whom he was employed from January, 1942, until May, 1950. He said that he contracted the disease as a result of inhaling particles arising from the operation of swing grinders and pneumatic tools. The firm denied liability. Lord Wheatley held that the defenders had failed in their duty to supply the pursuer with a respirator; that they had failed to maintain the pipes of dust-extraction plant in a proper manner; the that they had failed to provide an effective system of ventilation although it was practicable for them to do so.

THE GENERAL ELECTRIC COMPANY, LIMITED announce that they have undertaken as a comprehensive contract of over £2 million, the complete power station for the £20,000,000 iron and steel project of Colvilles, Limited, at Motherwell. The contract includes the power-house building and associated civil work; four Babcock and Wilcox gas- and oil-fired boilers of 125,000 lb. per hour each; three 10-Mw turbo-alternators with Mirrlees Watson condensing and feed-heating plant, feed pumps and auxiliaries; and two steam turbo-driven centrifugal blowers of 11,000 h.p. each, for supplying air to the new furnaces. In addition the work includes two ferro-concrete natural-draught towers, each for cooling 1,200,000 gallons of water per hour; and two pumps driven by turbines arranged to exhaust steam to process plant; also the 11 kv switchgear for control of the alternators and feeders, l.-t. switchgear and motors for auxiliaries, and the lighting installation.

Obituary

MR. ADAM BENNETT, who was general secretary of the National Union of Stove, Grate and General Metal Workers, with headquarters at Rotherham, from 1928 to 1953, has died at the age of 82.

MR. FRED OWEN, managing director of Owens Iron Foundry, Atherton, Lancashire, has died at the age of 59. His grandfather, Daniel Owen, and his father, Harry Owen, established the foundry in 1913.

MR. SIDNEY MATTHEW BARRAH, joint managing director of The Halford Cycles Company, Limited, of Birmingham, died on July 21 in his 79th year. He had been associated with the business since 1897. He rose from a warehouseman to appointment in 1928 as assistant managing director and in 1950 joint managing director.

MR. T. GALLOWAY, former works manager of Sellman & Hirst, Limited, hollow-ware manufacturers, Reliance Works, Derry Street, Wolverhampton, and afterwards with the Villiers Engineering Company, has died at the age of 67. He was 47 years with Sellman & Hirst from the age of 14 until the ownership changed in 1949, and then served the Villiers company.

MR. J. W. BAILLIE, who retired last December as managing director of Horseley Bridge and Thomas Piggott, Limited, Tipton, died on July 14 at the age of 70. He had spent 35 years in active management before his retirement, and continued to be a member of the Board. Mr. Baillie was for three years president of the British Constructional Steelwork Association and had been a member of the Council of the Federation of British Industries, of Birmingham Chamber of Commerce and of the British Welding Research Association.

MR. WILLIAM GEORGE RIDDELL, former chairman and managing director of John Hastie & Company, Limited, marine engineers, Greenock, died on July 22 at Durban, South Africa. Born at Jedburgh in 1871, he served his apprenticeship with the Fairfield Shipbuilding & Engineering Company, Limited, Glasgow. In 1901 he went to Finland as manager of the shipyard and engineering works of Crichton (now Crichton-Vulcan) at Abo. Two years later he returned to Greenock as joint managing director of John Hastie & Company, with the late Mr. Walter Graham. On the latter's retirement in 1918, Mr. Riddell became managing director and later chairman, positions he held until his retirement in 1924. He was awarded the O.B.E. in 1918 for his work for the Admiralty.

Raw Material Markets

Iron and Steel

As the holiday season advances activities at the foundries take on a more subdued tone. Stocktaking at many establishments is now in progress, and at most works deliveries of raw materials will be suspended during the holidays. Some of the engineering foundries, however, will accept deliveries of low- and medium-phosphorus irons, as they are anxious to build up stocks.

The engineering and speciality foundries maintain a fairly consistent level of output, and are well employed, with regular business coming forward to replace completed orders. Those providing castings for the motor and allied trades have good order-books, and many other outlets for castings ensure a satisfactory level of production. Their chief problem is the supply of pig-iron, and strenuous efforts are made to obtain larger tonnages of the low- and medium-phosphorus irons in particular, but without great success.

The light-castings trade, and some of the jobbing foundries, although showing signs of improvement, have yet to share fully in the better trading conditions experienced by other branches of the iron and steel trade. The light foundries supplying castings for domestic equipment need more support from home sources. Many of the jobbing foundries have a fair amount of work on hand, and the foundries supplying castings to the textile trade are moderately busy. The delivery of high-phosphorus pig-iron to these foundries is adequate for current needs, although equitable distribution of present supplies is made more difficult by the recent blowing-out of a furnace in the Derbyshire area.

In the main, the foundries are receiving sufficient supplies of foundry coke, although users of some grades of Welsh foundry coke are finding it difficult to obtain their full allocated tonnages.

Supplies of scrap are sufficient for current requirements. Light scrap is plentiful, but there is a good demand for the better and heavier grades of cast-iron and machinery scrap, as users now discriminate more in regard to quality.

The re-rollers are busier now than for some time, but meet no difficulty in obtaining the semi-finished steel they require. The heavy rolling mills are busy and there continues to be an almost unprecedented demand for sheets.

Non-ferrous Metals

All the markets in non-ferrous metals were affected last week by the news of the cease-fire in Indo-China and without exception prices were marked down, although Friday brought a rally which enabled the quotations to close above the worst. Nevertheless, tin lost £12 10s. for cash and £8 for three months, the backwardation being reduced to £5 10s. from £10 a week earlier. Both zinc and lead lost ground, the former being marked down by 25s. for July and by 22s. 6d. for second half October. The feature in lead was the reduction in the backwardation which came into £1. Lead on balance was £1 15s. lower for second half July and £1 down for second half October. Finally, copper, after a couple of weeks or more of almost complete stability, gave way rather sharply and fell to £235 for the cash position on Thursday last, the drop being due to persistent pressure during a good part of the week. However, on Friday's official market there was a recovery to £236 10s. and in the afternoon a further 5s. was added to the price, so that on balance cash lost £3 during the week, while three months dropped £1 12s. 6d. The backwardation narrowed to £1 and one hopes that this trend will continue, although the prospects of attaining a contango at present are perhaps somewhat remote. As things look in copper at the moment there is not much chance of a drop in the American quotation, which remains steady at 30 cents, and it seems reasonable, therefore, to look for an ultimate recovery in London, but the present bout of liquidation must spend itself first.

Details of non-ferrous metal usage and stocks in May have been issued by the Bureau of Non-Ferrous Metal Statistics. Stocks of virgin copper advanced by 5,200 tons to 65,314 tons at May 31, while consumption, virgin and scrap, at 47,298 tons, was up by nearly 5,000 tons. In zinc, stocks, at 38,409 tons, were virtually unchanged compared with 38,953 tons at the end of April. Usage, virgin and scrap, in May was 27,551 tons, compared with 26,084 tons in April. Lead, too, did quite well, with stocks of virgin only slightly lower, at 29,793 tons, while consumption of all grades, at 28,637 tons, showed a very useful increase on the April figure of 25,820 tons. Consumption of tin was up by 30 tons to 1,732 tons, while stocks also increased, the figure of 4,347 tons comparing with 4,065 tons at April 30.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* July 22, £234 15s. to £235; July 23, £236 to £236 10s.; July 26, £235 15s. to £236; July 27, £235 10s. to £236; July 28, £235 5s. to £235 10s.

Three Months: July 22, £234 to £234 5s.; July 23, £235 10s. to £235 15s.; July 26, £235 to £235 5s.; July 27, £234 15s. to £235; July 28, £234 15s. to £235.

TIN, Standard—*Cash:* July 22, £751 to £752; July 23, £755 to £756; July 26, £755 to £756; July 27, £748 to £750; July 28, £746 to £748.

Three Months: July 22, £745 to £746; July 23, £749 to £750; July 26, £752 to £752 10s.; July 27, £746 to £747; July 28, £742 10s. to £743.

ZINC—*July:* July 22, £76 15s. to £77; July 23, £76 17s. 6d. to £77; July 26, £76 to £76 5s.; July 27, £75 10s. to £75 15s.; July 28, £75 to £75 5s.

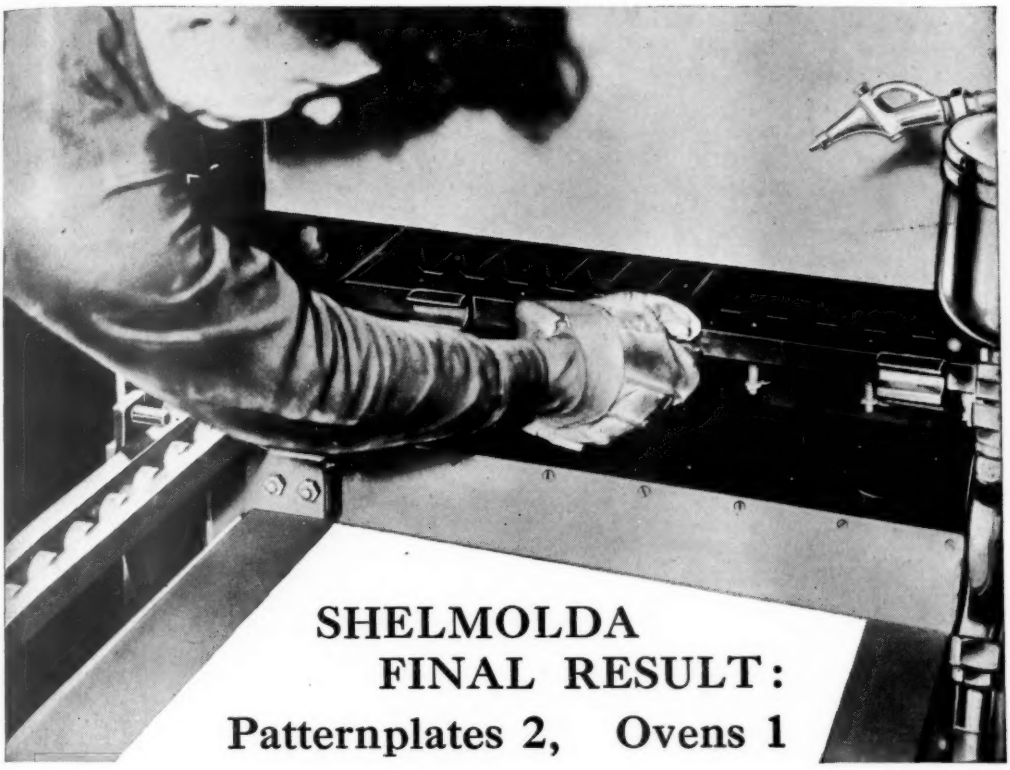
Second half October: July 22, £77 to £77 5s.; July 23, £77 2s. 6d. to £77 5s.; July 26, £76 10s. to £76 15s.; July 27, £76 to £76 5s.; July 28, £75 15s. to £76.

LEAD—*Second half July:* July 22, £94 5s. to £94 15s.; July 23, £94 10s. to £94 15s.; July 26, £94 10s. to £94 15s.; July 27, £94 10s. to £94 15s.; July 28, £93 15s. to £94 5s.

Second half October: July 22, £93 5s. to £93 10s.; July 23, £93 10s. to £93 15s.; July 26, £93 5s. to £93 10s.; July 27, £93 5s. to £93 10s.; July 28, £92 10s. to £92 15s.

AN ORDER prohibiting the emission of smoke from premises, including private houses, in the Markfield area of Tottenham, North London, has been made by Tottenham Corporation and is the first to be confirmed by the Minister of Housing and Local Government in Greater London.

THE BRITISH TRADE FAIR, which is to be held at Baghdad from October 25 to November 8, will be opened by King Feisal of Iraq. Mr. D. Heathcoat Amory, Minister of State, Board of Trade, and Sir Harry Pilkington, president of the Federation of British Industries, will be present.



SHELMOLDA FINAL RESULT: Patternplates 2, Ovens 1

It's a winner, right enough, and here's why:

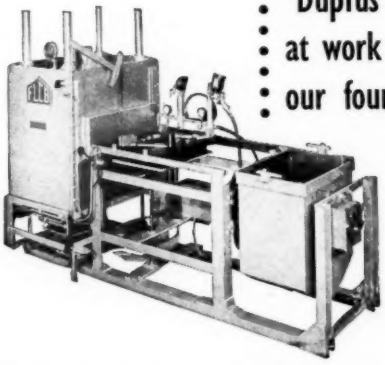
1. The single oven of the Shelmolda Duplus does the work of two. While one shell is being cured the other patternplate is being invested with a new shell.

2. The heat is applied evenly—above, below, at every side. Whatever the depth of pattern, the Shelmolda shell is cured evenly.

3. Production—can you get, anywhere, a greater output with lower running costs at anything like this price?

OUTPUT: 50/60 moulds per hour. *DELIVERY:* 8/10 weeks. *PRICE:* £575

May we show you the Shelmolda 'Duplus' at work in our foundry?



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DUPLUS

(Patent Applied For)

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Telephone: LEEDS 32041

236.62

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

July 28, 1954

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £14 19s. 6d.; Birmingham, £14 12s. 9d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 5s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £17 16s. 9d.

Scotch Iron.—No. 3 foundry, £17 9s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £18 19s. 6d.; South Zone, £19 2s. 0d.

Refined Malleable.—P, 0.10 per cent. MAX.—North Zone, £19 19s. 6d.; South Zone, £20 2s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £17 14s. 6d.; Scotland (Scotch iron), £18 1s. 0d.; Sheffield, £18 19s. 0d.; Birmingham, £19 6s. 6d.; Wales (Welsh iron), £18 1s. 0d.

Basic Pig-iron.—£15 10s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £42 0s. 0d., basis 45 per cent. Si, scale 17s. per unit; 70/84 per cent., £65 0s. 0d., basis 75 per cent. Si, scale 18s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £185 0s. 0d. to £195 0s. 0d. per ton; 38/40 per cent., £251 0s. 0d. to £270 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 13s. 9d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 16s. 9d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £75 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £74 0s. 0d. to £76 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; MAX. 2 per cent. C, 2s. 0½d. per lb. Cr; max. 1 per cent. C, 2s. 1d. per lb. Cr; max. 0.15 per cent. C, 2s. 2d. per lb. Cr; max. 0.10 per cent. C, 2s. 2½d. per lb. Cr; max. 0.06 per cent. C, 2s. 2½d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 6½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 12s. 6d.; tested, 0.08 to 0.25 per cent. C, £26 12s. 6d.; hard (0.41 to 0.60 per cent. C), £28 0s. 0d.; silico-manganese, £33 16s. 0d.; free-cutting, £28 16s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 12s. 0d.; silico-manganese, £34 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 0s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £32 9s. 0d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £32 7s. 0d.; flats, 5 in. wide and under, £32 7s. 0d.; hoop and strip, £33 9s. 0d.; black sheets, 17/20 g., £42 1s. 0d.; galvanized corrugated sheets, 24 g., £51 8s. 6d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £53 8s. 0d.; nickel-chrome, £75 2s. 0d.; nickel-chrome-molybdenum, £84 13s. 6d.

NON-FERROUS METALS

Copper.—Cash, £235 5s. 0d. to £235 10s. 0d.; three months, £234 15s. 0d. to £235 5s. 0d.; settlement, £235 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 27⅞d. per lb.; wire, 268s. 9d. per cwt. basis; 20 s.w.g., 300s. 0d. per cwt.

Tin.—Cash, £746 0s. 0d. to £748 0s. 0d.; three months, £742 10s. 0d. to £743 0s. 0d.; settlement, £748 0s. 0d.

Zinc.—July, £75 0s. 0d. to £75 5s. 0d.; second half October, £75 15s. 0d. to £76 0s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £106 0s. 0d.; rolled zinc (boiler plates), all English destinations, £103 15s. 0d.; zinc oxide (Red Seal), d/d buyers premises, £96 0s. 0d.

Lead (Refined Pig).—Second half July, £93 15s. 0d. to £94 5s. 0d.; second half October, £92 10s. 0d. to £92 15s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 22⅞d. per lb.; rods, drawn, 32½d.; sheets to 10 w.g., 259s. 3d. per cwt.; wire, 30½d.; rolled metal, 245s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £165; B6 (85/15), £208 ; BS249, £175.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £202; HTB2 (38 tons), £210; HTB3 (48 tons), £220.

Gunmetal.—RCH, 3/4 per cent. tin, — ; BS1400, LG2 (85/5/5/5), £198; LG3 (86/7/5/2), £207; G1 (88/10/2/½). £279; (88/10/2/1), £270.

Phosphor Bronze.—BS1400, PB1 (AID released), £290 per ton.

Phosphor Bronze Strip, etc.—Strip, 366s. 0d. per cwt.; sheets to 10 w.g., 388s. 6d. per cwt.; wire, 45½d. per lb.; rods, 39¾d.; tubes, 38d.; chill cast bars: solids 40½d., cored 41½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 1¾d. per lb.; round wire, 10g., in coils (10 per cent.), 3s. 7d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 6d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex warehouse, £100 0s. 0d. Nickel, £483 0s. 0d. Aluminium, ingots, £156 0s. 0d.; aluminium bronze (BS1400), AB1, £251; AB2, £260. Solder, brazing, BS1845, 1s. 11d. lb.; granulated, 2s. 2d. lb.

Company News

HAMMOND LANE FOUNDRY COMPANY, LIMITED, Dublin—The net profit for the year ended March 31 after all expenses and tax was £21,053, compared with £17,778 in the previous year. A dividend of 15 per cent., against 12½ per cent., is being paid.

CROFTS ENGINEERS (HOLDINGS), LIMITED—The company has acquired the whole of the share capital of J. Parkinson & Son (Shipley), Limited, machine-tool and vice makers, of Shipley (Yorks), which will continue to operate as before with the same staff and management.

W. H. ALLEN, SONS & COMPANY, LIMITED, mechanical and electrical engineers, of Bedford—The chairman, Sir Richard Allen, states that since the end of the year projects have been under active consideration which will involve further substantial finance over the next few years.

HEAD, WRIGHTSON & COMPANY, LIMITED, engineers and founders, of Thornaby-on-Tees (Yorks)—Authorizations for capital expenditure, spread over four years, amount to some £655,000, of which £475,000 relates to the parent company. Official orders placed to date, states Mr. Richard Miles, chairman, total approximately £340,000.

NEGRETTI & ZAMBRA, LIMITED, scientific instrument makers, of London, W.1—An interim dividend of 3 per cent. has been declared in respect of the year ending September 30. It is payable on the equity capital doubled by the free issue of £175,000 "A" ordinary shares and compares with an interim of 5 per cent. on the old capital, equivalent to 2½ per cent. on the present amount.

GEORGE COHEN, SONS & COMPANY, LIMITED, engineers and iron, metal, and machinery merchants, of Hammersmith, London, W.6—The preliminary statement shows a sharp fall in the group profit from £1,764,760 to £1,214,536 for the year to March 31. The ordinary dividend is maintained at 12 per cent. with a recommended unchanged final dividend of 8½ per cent.

JOHN HOLROYD & COMPANY, LIMITED, bronze founders, etc., of Rochdale—The directors propose the redesignation of 4,000,000 5s. shares as "A" shares, and an increase in the capital to £1,500,000 by the creation of 2,000,000 "B" ordinary 5s. shares. It is intended to capitalize £500,000 of reserve and to issue 2,000,000 "B" ordinary shares on the basis of one new for each old ordinary share held ranking *pari passu*.

WHESSOE, LIMITED—Mr. H. G. Judd, the chairman, says that steelplate requirements of atomic energy developments open an encouraging prospect for the company. On longer views of future prospects, increasingly keen competition for a smaller market demand is being met, and a reversion from peak conditions to more normal trading with materially lower levels of turnover and of profits than in recent years must be anticipated.

A. P. V. COMPANY, LIMITED, aluminium founders, etc., of London, S.W.18—Dr. Richard J. S. Seligman, chairman, says that orders received by the company in the second half of 1953 were 50 per cent. greater than in the first half, and this progress continued in the first half of 1954, and "at an increased rate," so that orders in hand are at a peak level. The foregoing applies to the subsidiaries except the home subsidiary Paramount Alloys, Limited, which made "a serious loss" in 1953 instead of a profit in 1952. The future, the chairman adds, is far from discouraging.

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N.F. METALS & ALLOYS
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LIVERPOOL, 2. 13, Rumford St., Central 1558
GLASGOW, C.2. 93, Hope Street, Central 9969

NOTICE

Replies to Box Numbers to be addressed to "Foundry Trade Journal," 49, Wellington Street, London, W.C.2.

SITUATIONS WANTED

YOUNG FOUNDRY MANAGER (33), well educated, keen and energetic, technically trained by well-known firm, City and Guilds, A.I.D. radiologist, successful practical experience starting prosperous grey iron and non-ferrous jobbing foundry, floor, plate, machine moulding, estimating, costing, buying, customer liaison, etc., used full control, seeks progressive situation.—Box YF652, FOUNDRY TRADE JOURNAL.

REPRESENTATION required by experienced and fully trained Foundryman, to cover the Southern half of England. Thorough practical and technical knowledge of trade. Capable of working on own account. Interested in foundry supplies, metals, ferrous and non-ferrous, Machinery, and general equipment.—Box RR610, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN/MANAGER desires change. Life experience trade Practical and Technical; grey iron jobbing, marine, machine tool, and general engineering castings. Accustomed take full control. Moderate salary/results bonus. Box FF666, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER, 49. Life experience, ferrous and non-ferrous. Vast practical and technical experience; developments, materials, modern technique. Foundry finance. 14 years managerial, desires change, preferably complete charge of medium or small foundry. Box FM665, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive or a woman aged* 18-59 *inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order,* 1952.

SKILLED NON-FERROUS MOULDER required. High-class light and medium sand work. Permanent post in old-established business. 5-day week.—Further details apply DANIEL YOUNG, LTD., Witney, Oxon.

METALLURGIST required for Malleable Iron Foundry (Blackheart) in the Yorkshire area. Applicant should have had experience in a similar position.—Please give full particulars of past experience and present position, which will be treated in strict confidence, to Box MR659, FOUNDRY TRADE JOURNAL.

SALES OFFICE ESTIMATOR required for Steelfoundry.—Apply in writing, giving full details of experience, etc., Box SO621, FOUNDRY TRADE JOURNAL.

CORE SHOP FOREMAN. Leading foundry in North Midlands requires a young energetic man to fill the above vacancy. Applicants must be experienced in repetition coremaking, use of core-blowers and able to control female labour. Must be capable of advising on design of coremaking equipment, have knowledge of sand control and use of resin binders. Apply Personnel Manager, Box CS662, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

WORKS ENGINEER required for expanding Foundry in Glasgow area. Must be experienced in the design and layout of foundry plant, and capable of taking general control of maintenance. This is a permanent position, and will carry membership of a superannuation scheme.—Particulars of experience and present salary in confidence to Box WE645, FOUNDRY TRADE JOURNAL.

APPLICATIONS invited from fully skilled IRON AND NON-FERROUS MOULDERS for a Foundry on the South Coast. Good basic pay with pension and profit sharing schemes in operation.—Write, giving full details, to Box AI644, FOUNDRY TRADE JOURNAL.

SALES OFFICE ESTIMATOR required for Steelfoundry.—Apply in writing, giving full details of experience, etc., Box SO643, FOUNDRY TRADE JOURNAL.

METALLURGICAL CHEMIST for well equipped foundry and laboratory engaged on interesting development work, coupled with high class foundry production. Should have H.N.C. or similar and some ferrous experience. Excellent opportunity for young man to gain valuable knowledge and experience in progressive post. South-West Birmingham. State age, experience, salary, etc.—Box MC656, FOUNDRY TRADE JOURNAL.

MECHANIC required, with experience of "B.M.M." moulding machines, to service an installation of 32 Turnover and Straight draw type machines in a South African Foundry.—Replies to Box MR614, FOUNDRY TRADE JOURNAL.

METALLURGIST, to control melting, sand and annealing at Blackheart Malleable Iron Foundry in Midlands. Must be capable of producing the highest quality iron and have progressive ideas.—Apply, stating age, experience, and salary required, to Box MT653, FOUNDRY TRADE JOURNAL.

GRAVITY DIE FOUNDRY (Aluminium) in Midlands requires SHOP MANAGER. Must be practical man, capable of taking full charge of labour and production; age 30/40. Four-figure salary for the right man.—Box GD616, FOUNDRY TRADE JOURNAL.

JOBBING MOULDERS required, London shop; also CUPOLA FURNACEMAN.—Apply PLANT, MACHINERY & ACCESSORIES, LTD., 136/140, Bramley Road, W.10.

FOREMAN.—Non-ferrous and Ferrous foundry in the West Country, for Architectural, Statutory, and General Engineering Castings up to 2 tons. Applicants should have had good technical training, also practical experience, including estimating. State full details.—Box FN 648, FOUNDRY TRADE JOURNAL.

FOUNDRY METALLURGIST required for West Midlands. Must have sound experience of High Duty Iron, and it would be advantageous to have some knowledge of Malleable Iron.—Box FR657, FOUNDRY TRADE JOURNAL.

UNIVERSAL MILLERS for Birmingham and Manchester. First-class men, used to high-class work to dead-on limits. Excellent conditions and highest possible remuneration. Particularly accustomed to handling latest and largest Huron, Cincinnati and similar universal milling machines.—Write full particulars of experience to WRIGHT & PLATT, LTD., the world's largest engineering master patternmakers, Irving Street, Birmingham, 15.

SITUATIONS VACANT—*contd.*

FOUNDRY METALLURGIST for Automobile Foundry to assist in controlling of metal, sand, etc. Dudley Area. State age, experience and salary required. Box FM672, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT for small non-ferrous and aluminium Foundry (Nottingham) producing high quality sand castings. Must be adaptable, have sound technical knowledge and capable of taking full charge. State age, experience, fully &c. Box FS671, FOUNDRY TRADE JOURNAL.

FOREMAN PATTERNMAKER required for Midlands. Must be first class wood and metal man, able to estimate and check, and to control labour. Good technical and general education. Permanent position for suitable applicant. State age, salary at present received and required, and full details of experience. Box FP670, FOUNDRY TRADE JOURNAL.

A TECHNICAL REPRESENTATIVE is required by Bagshawe & Company Limited, Dunstable Works, Dunstable, to handle sales of malleable iron castings. Previous experience of foundry sales and/or some practical foundry experience will be an advantage. Applications, which will be treated in confidence, must state full details of experience and salary required.

TECHNICAL ASSISTANT.—An expanding Foundry in the North-East, producing Non-ferrous (principally Aluminium Alloy) sand, shell, and gravity die castings, has a vacancy for a Technical Assistant, with sound Foundry Drawing experience, educated to H.N.C. standard, and preferably with some foundry experience. Salary according to ability and previous experience, with excellent prospects of promotion to Foundry Manager. Housing assistance if required.—Reply, giving full details of career to date, age, etc., to:—MANAGING DIRECTOR, Daralum Castings, Ltd., Longfield Road, Darlington.

PATTERNMAKERS, experienced in both wood and metal, wanted in Birmingham and Manchester by the world's largest engineering master patternmakers. Must be accustomed to highest standards and accuracy, and prepared to work overtime. Ideal conditions, top remuneration.—Write full particulars of experience to Head Office, WRIGHT & PLATT, LTD., Irving Street, Birmingham, 15.

FOUNDRY MANAGER required with sound Metallurgical knowledge. Applicants having good Foundry experience only will be considered This position offers first class opportunities to men with initiative and drive. Apply in writing, giving particulars and salary required to Box FM667, FOUNDRY TRADE JOURNAL.

DIE DESIGNER required for Investment Castings Foundry. Applicants should have design experience of pressure injection dies. Previous experience in Investment Castings desirable but not essential. Please write in confidence, stating age and giving full details of previous experience to The Personnel Officer, The de Havilland Engine Co. Ltd., Stag Lane, Edgware, Middlesex.

FOREMAN to take complete control Non-ferrous Foundry in Yorkshire. Knowledge copper and white metals. Complement 30 men. Replies to Box FT668. FOUNDRY TRADE JOURNAL.

SKILLED NON-FERROUS MOULDERS required. Light and medium, dry and green sand-work. Top rates of pay and piecework. Permanent employment with an old-established firm in Yorkshire Accommodation found for single men.—Write Box 9906, C.P.P., 35, Morley Street, Bradford.